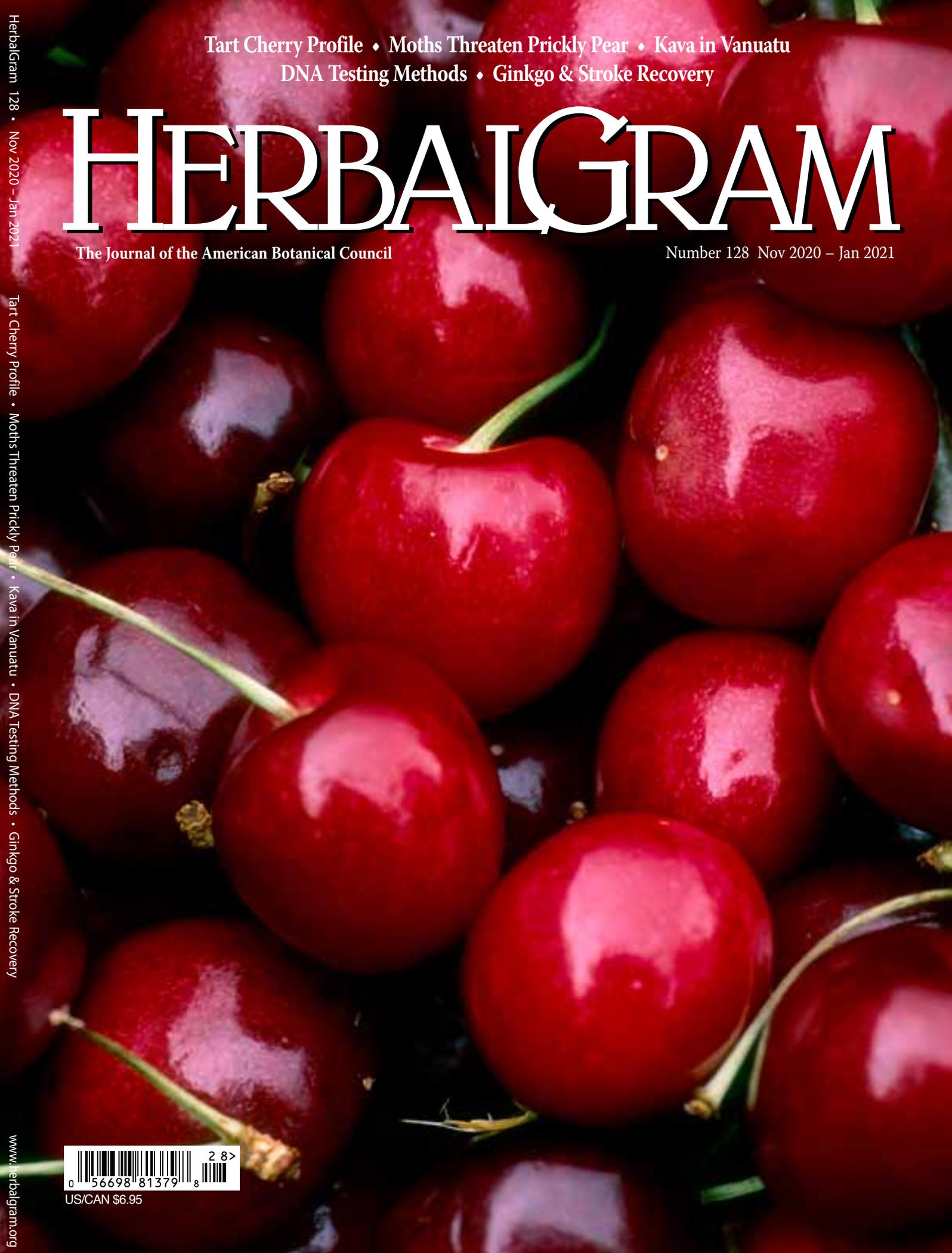


Tart Cherry Profile • Moths Threaten Prickly Pear • Kava in Vanuatu
DNA Testing Methods • Ginkgo & Stroke Recovery

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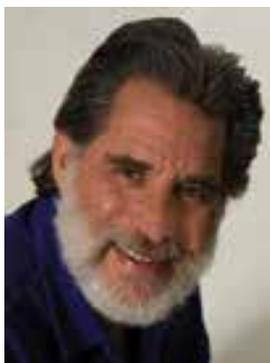
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dear reader

The cover story of this issue is our Herb Profile on tart cherry. This fruit is another example of the food-as-medicine proposition, or rather, that food *is* medicine. A tip of the hat to our valued friends and colleagues Josef Brinckmann and Thomas Brendler for providing yet another engaging profile of a beneficial medicinal plant.

Our good friend and frequent contributor “Medicine Hunter” Chris Kilham provides insights into the culture and market prospects of kava, one of our favorite medicinal plants, in the South Pacific island country of Vanuatu. Chris has visited Vanuatu 15 times over the past 25 years and was Vanuatu’s Honorary Consul to the US from 1997 to 2000. His travelogue-style and image-rich reporting will provide readers — especially those who might be feeling a bit confined during the pandemic — with a sense of adventure and appreciation for this culturally revered plant.

In the southern and western areas of Texas we have lots of prickly pear cacti, which belong to the genus *Opuntia*. Indigenous peoples and Hispanics in Texas and northern Mexico have valued the cactus as a traditional food: The pads, called *nopales*, are delicious with scrambled eggs, and the fruits, called *tunas*, are a late-summer delicacy. Nopales also are used as a traditional remedy for maintaining normal blood sugar levels in people with type 2 diabetes, which is one of the leading causes of death in Mexico. Prickly pear provides another example that food is medicine. Unfortunately, from a conservation perspective, Texas’ native prickly pear populations are now being threatened by a highly destructive, invasive moth whose larvae devour the cactus pads from the inside out. *HerbalGram* Assistant Editor Connor Yearsley’s article describes how researchers at the University of Texas at Austin and their colleagues are working to address this “prickly predicament” and prevent or slow the spread of the moth to Mexico.

Testing for proper botanical identity is a requirement for all botanical dietary ingredients according to Good Manufacturing Practices in the United States and many countries. Since 2010, we have published several articles on the benefits and limitations of genetic testing technologies for determining accurate botanical identification. Over the past decade, DNA testing methods have improved and costs have lowered to the point that DNA-based analytical methods are now a more common part of the laboratory analytical toolkit. DNA testing expert David L. Erickson, PhD, co-founder and CEO of the analytical lab DNA4 Technologies, has written an article that provides an enlightened overview of this important and relevant topic.

Speaking of testing, as we were completing this issue, we received news that our paper “Botanical ingredient adulteration – how some suppliers attempt to fool commonly used analytical techniques” was just published in the peer-reviewed scientific journal *Acta Horticulturae*. The paper was written primarily by ABC Chief Science Officer Stefan Gafner, PhD, with Steven Foster, John H. Cardellina II, PhD, Ikhlas A. Khan, PhD, Roy Upton, and me as co-authors, based on the work that we have been doing for nine years as the ABC-AHP-NCNPR Botanical Adulterants Prevention Program (BAPP). The paper is based on a presentation by Stefan at the 30th International Horticultural Congress of the International Society for Horticultural Science in 2018.

The article includes nine references to BAPP publications and discusses three common laboratory analytical techniques and 15 herbal ingredients that can be intentionally adulterated to trick these methods into falsely authenticating the identity of these materials — a significant problem in the international medicinal plant ingredients market. BAPP and its emphasis on authentic ingredients and accurate labeling demonstrates ABC’s commitment to an important aspect of the world of herbal medicine. With the program’s efforts to help reduce and eliminate adulteration and fraud, millions of consumers can continue to access a hopefully increasing level of reliable and beneficial medicinal and aromatic plant products. HG

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Prickly pear *Opuntia macrorhiza*
Photo ©2020 Steven Foster

50 Prickly Pear Predicament: Cactus Moth Arrives in Texas

By Connor Yearsley

The recent arrival of the “voracious,” invasive cactus moth in Texas spells trouble for native, iconic prickly pear cacti, which are ecologically and economically important species. The moth’s larvae devour the cactus pads from the inside out and can leave entire cactus stands in rotting masses. To control the moth in Texas and prevent or slow its spread to Mexico, scientists at the University of Texas at Austin are planning to introduce a parasitoid wasp species, which is a natural enemy of the moth. But time is critical.

58 DNA Testing Methodologies in Botanical Quality Control Programs

By David L. Erickson, PhD

DNA testing can determine the evolutionary identities of species and has been used to authenticate botanical materials for at least 25 years. As these tests become less expensive, faster, and more accurate, they are being applied more widely for quality control and as part of regulatory programs. This article introduces basic principles and types of DNA tests, highlights their strengths and limitations, clarifies some misconceptions, and suggests how they may complement chemical and morphological methods to help ensure the authenticity, purity, and safety of botanical dietary supplements.

64 The Rising and Falling Fortunes of Vanuatu Kava

By Chris Kilham

In February 2020, Chris Kilham traveled to the Republic of Vanuatu, an island country in the South Pacific, to gain a better understanding of the kava trade there. Kava, the root of which has well-documented anxiolytic and sedative properties, is the source of the traditional beverage of the same name that has enjoyed great popularity in the South Pacific and, in the past few decades, gained international attention. Kilham has monitored the kava trade in Vanuatu since 1995, but recent events, including Cyclone Harold and the COVID-19 outbreak, have created a unique situation and unprecedented hardships for kava farmers, producers, and exporters.

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Cherries *Prunus* sp.

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Tart cherry *Prunus cerasus*
Photo ©2020 Steven Foster

Tart Cherry

Prunus cerasus (syn. *Cerasus vulgaris*)
Family: Rosaceae

By Josef Brinckmann and Thomas Brendler

INTRODUCTION

The rose (Rosaceae) family genus *Prunus* comprises five subgenera and about 200 species.¹ *Prunus* is taxonomically complex, and different botanical authorities over the centuries have either split the genus into multiple genera or recognized a wider *Prunus* “*sensu lato*” (“in the broad sense”).² *Prunus* includes more than 30 species of trees with fruits considered to be types of cherries. Most of these are indigenous to Asia and Europe.³ Tart cherry (*P. cerasus*), also known as sour cherry, is a small tree, rarely exceeding eight meters (26.2 ft) tall, with dark red fruits that have a characteristic acidic taste.⁴ The seeds contain kernels that have an odor similar to that of bitter almonds (*Prunus dulcis* var. *amara*, Rosaceae).⁵ Some sources report the origin of

P. cerasus in the area between the Caspian Sea and the north Anatolia mountain ranges (in Azerbaijan, Georgia, Armenia, and Turkey),⁶ while others report a somewhat wider geographic origin from western Asia (Anatolia to the Caucasus) and west to neighboring parts of eastern Europe (Bulgaria and Macedonia).^{5,7}

Prunus cerasus is among the first fruit trees known to be used by humans.⁸ Tart cherry is closely related to ground cherry (*P. fruticosa*)⁴ and sweet cherry (*P. avium*),⁹ and it is believed that *P. cerasus* originated from spontaneous hybridization between the two.⁸ The parental species (*P. fruticosa* and *P. avium*) have partially different geographic ranges of distribution, but the range of wild *P. cerasus* trees corresponds with the overlapping area where the ranges of



Tart cherry *Prunus cerasus*
Photo ©2020 Jörg Hempel

the parents meet in southeastern Europe and southwestern Asia.¹⁰ *Prunus avium* is also a progenitor of Duke cherry (*P. × gondouinii*).⁹

Kütahya province in the Aegean region of Turkey is traditionally known for its diversity of tart cherry types. Studies performed on *P. cerasus* populations in the Aegean region and in Gaziantep in the Southeast Anatolia region found a rich variation among tart cherry types “in terms of fruit size, color, taste, shape (mostly round, and more rarely oblate, heart, and kidney shaped), juice color and yield, fruit/pit ratio, aroma, total soluble solids and total yield.”⁶ In the early 1990s, 115 different types of *P. cerasus* fruits collected from the Aegean, Central and Northern Anatolia, and Marmara regions of Turkey were analyzed, of which 13 accessions were selected as the most promising for commercial cultivation in Turkey and registered as new cultivars.¹¹

In 2019, about 53,540 metric tons (MT) of fresh tart cherries were exported globally.¹² The top five exporters in terms of volume were Serbia (14,250 MT), Hungary (10,322 MT), Poland (5,210 MT), the United States (3,176 MT), and Czechia (2,703 MT). The United States imported 4,583.3 MT of frozen tart cherries in 2019, mainly from Canada, with relatively minor amounts from

Poland, Turkey, and a few other countries.¹³ The tart cherry crop in the United States is subject to marketing order regulations implemented by the US Department of Agriculture (USDA) for the purposes of providing stable markets and improving grower returns. The 2019–2020 crop year pursuant to the marketing order includes tart cherries grown in the states of Michigan, New York, Oregon, Pennsylvania, Utah, Washington, and Wisconsin.¹⁴ The tart cherry crop in the United States is also subject to extreme genetic vulnerability to pests, diseases, and unfavorable weather conditions. This is due to genetic uniformity and geographic concentration (most of the production has been concentrated in northwestern Michigan and northeastern Wisconsin using a single cultivar, “Montmorency”).³

Other *Prunus* species and plant parts also are used in food and medicine, such as black cherry (*P. serotina*), Chinese sour cherry (*P. pseudocerasus*), and sweet cherry. However, this article concerns mainly the fruit of *P. cerasus*.

HISTORY AND CULTURAL SIGNIFICANCE

In 1700, French botanist Joseph Pitton de Tournefort (1656–1708) named the genus *Prunus* in the publication *Institutiones Rei Herbariae*.¹⁵ Swedish botanist Carl

Linnaeus (1707–1778) named the species *P. cerasus* in his 1753 work *Species Plantarum*.¹⁶ The Latin genus name *Prunus* derives from the Greek *proumnon*, meaning “wild plum.”¹⁷ The Latin species name *cerasus* was the common name used by the Romans,¹⁸ and some report that it was derived from the name of a city “Kerasus,” which is in the Black Sea region of Turkey and is known today as Giresun.⁶ However, some authors dispute that account and assert that the Latin *cerasus* and corresponding Greek *kerasos* were not derived from the name of the city Kerasus, but rather that the city was named after the cherry trees growing there.¹⁷

Preparations with tart cherry fruits were reportedly given to Roman army soldiers who suffered from mild to moderate pain on the battlefield.¹⁹ In the first century, naturalist Pliny the Elder (23 or 24–79) did not distinguish between sweet and tart cherries, but wrote that they were unknown in Italy before the time of late Roman Republic politician Lucius Lucullus (118–57 or 56 BCE), who was credited with bringing cherries from Pontus (in the eastern Black Sea region of Turkey) in 74 BCE. However, French-Swiss botanist Alphonse de Candolle (1806–1893), in his 1883 book *Origin of Cultivated Plants*, claimed that *P. cerasus* already had been naturalized in Europe at the start of the Greek civilization and was brought to Italy later but well before the time of Lucullus in 74 BCE. *Prunus cerasus* fruits were among the carbonized plant materials found at the base of the lararium (shrine to guardian spirits) at the House of the Garden of Hercules in Pompeii, which was preserved after the volcanic eruption of Mount Vesuvius in 79 CE.¹⁸ Greek physician Claudius Galenus (129–ca. 216 CE), also known as Galen of Pergamon, ascribed an astringent effect of *P. cerasus* fruit in book two of his treatise *De alimentorum facultatibus* (“On the Properties of Foodstuffs”).²⁰

The *P. cerasus* tree was brought to Germany during the occupation by the Roman Empire.⁷ Tart cherry has since become one of the more important stone fruit crops of Germany.²¹ Today, 39 registered varieties are approved for cultivation in Germany.²² A study investigating the mycobiome (fungal microbiome) of *Prunus* trees in Germany found that *P. cerasus* trees were host to 61 fungal species, some that could not be identified, meaning that tart cherry trees represent a habitat that harbors potentially new species, or even new genera, of fungi.²¹

Traditional Medicinal Uses

In the traditional Unani system of medicine, *P. cerasus* fruit, known as *alu balu*, is used in formulations to treat conditions such as urinary tract infections, nephrolithiasis (kidney stones), cystolithiasis (calculi [stones] in the urinary bladder), and dysuria (painful urination).²³ For example, *alu balu* is listed as a component of formulations monographed in the Government of India’s *National Formulary of Unani Medicine* for the treatment of renal and vesicle calculi.²⁴

In Iran, *P. cerasus* seeds have been used in confections and are considered to have nutritive and tonic properties. Tart cherry pits mixed with barley (*Hordeum vulgare*, Poaceae) awns (needle-like extensions from the top of lemmas of the

florets) and cherry stems are prepared as an herbal tea infusion for treating gonorrhea.⁵

Villagers in the mountainous Peshkopia region of north-eastern Albania, near the border with North Macedonia, prepare an herbal tea infusion of wild-collected *P. cerasus* fruit peduncles for medicinal use as a diuretic.²⁵ In western Europe, the fresh fruits with the pits traditionally were used to prepare Sirupus Cerasi (cherry syrup), which was used to treat fever and liver diseases.²⁶ Traditional European uses of *P. cerasus* fruit and peduncle of fruit, submitted to the European Food Safety Authority (EFSA) for an opinion, including “traditionally used to facilitate the digestion,” have not been accepted by the EFSA.²⁷

CURRENT AUTHORIZED USES IN COSMETICS, FOODS, AND MEDICINES

In the United States, tart cherries are used mainly as conventional food, as well as for food coloring and flavoring, but also as a component of dietary supplement products. Official quality standards monographs for Cherry Juice NF, the liquid expressed from the fresh ripe fruit of *P. cerasus*, containing not-less-than 1% malic acid, and Cherry Syrup NF (prepared from Cherry Juice NF) are available in the *National Formulary*, which is published by the United States Pharmacopeial Convention (USP).²⁸ USP recognizes the need to develop a corresponding monograph for the starting material, tart cherry fruit, as a dietary ingredient (Maria Monagas, PhD, scientific liaison for dietary supplements and herbal medicines at USP, email to T. Smith, October 16, 2020). There are also “United States Standards for Grades of Frozen Red Tart Pitted Cherries” (US Grade A or US Fancy; US Grade B or US Choice; US Grade C; and Substandard)²⁹ and “United States Standards for Grades of Red Sour Cherries for Manufacture” (US No. 1 and US No. 2).³⁰

Tart cherry pit is classified as Generally Recognized as Safe (GRAS) by the US Food and Drug Administration (FDA) for use as a natural flavoring substance in conventional foods with the limitation not-to-exceed 25 ppm prussic acid (also known as hydrogen cyanide).³¹ The FDA also provides specifications for canned fruit cocktail containing approximate halves or whole pitted *P. cerasus* cherries in the *Code of Federal Regulations* (21CFR Part 145).³² The USDA permits the use of nonorganically-produced cherry juice color, derived from *P. cerasus*, as an exempted ingredient in processed products that are labeled as certified organic, but only when organic cherry juice color pigment is not commercially available.³³ The US National Institutes of Health’s (NIH’s) Dietary Supplement Label Database lists 166 dietary supplement products containing cherry extract, but this includes extracts of both tart and sweet cherry.³⁴

In Canada, in addition to use as a conventional food, tart cherry fruit may also be used as an active ingredient of licensed natural health products (NHPs), which require pre-marketing authorization from the Natural and Non-prescription Health Products Directorate (NNHPD).³⁵ Licensed NHPs that contain a tart cherry preparation



Cherries *Prunus* sp.
Photo ©2020 Steven Foster

equivalent to 15 grams of dried tart cherry fruit or 100 grams of fresh tart cherry fruit may be labeled with a claim statement to the effect of “Provides antioxidants that help protect against cell damage caused by free radicals.”³⁶ Certain tart cherry ingredients also are permitted for use as non-medicinal components of licensed NHPs. For example, tart cherry fruit juice or fruit powder may be used as a flavor enhancer, and the dried juice may be used as a color additive and flavor enhancer.³⁵

In the European Union (EU), extract of *P. cerasus* fruit is authorized for use as an antioxidant and skin-conditioning component of cosmetic products. The fruit water (aqueous solution of the steam distillates obtained from the fruit) is authorized for use as a skin-conditioning emollient, and the juice expressed from the fruit as a skin conditioner.³⁷ In 2010, the EFSA issued an opinion that a cause-and-effect relationship has not been established between the consump-

tion of *P. cerasus* fruit and/or peduncle of fruit and a beneficial physiological effect related to an “increase in renal water elimination (i.e., diuresis).”³⁸ Regarding proposed antioxidant health claims for preparations of *P. cerasus* such as fruit concentrate and freeze-dried extract, the EFSA issued an opinion that no evidence had been provided to establish that having antioxidant activity/content and/or antioxidant properties is a beneficial physiological effect.³⁹

MODERN RESEARCH

The biochemistry and pharmacology of tart cherry have only recently been reviewed.^{40,41} Anthocyanins in tart cherry juice not only have shown significant antioxidant activity, but also have inhibited enzymes involved in diabetes in a dose-dependent manner. Additionally, anti-inflammatory effects have been demonstrated both in vitro and in vivo.

General health benefits,⁴²⁻⁴⁴ pharmacokinetics and pharmacodynamics,⁴⁵ and clinical data on the effects of tart cherry on exercise-induced muscle damage,⁴⁶ exercise performance,^{43,47,48} reduction of serum uric acid concentrations and gout,⁴⁹ vascular function,⁵⁰ blood pressure,⁵¹ and pain⁴¹ have been reviewed extensively and meta-analyzed. In various exercise protocols, exercise-related muscle damage was shown to be alleviated, and muscle contractility and endurance improved with tart cherry preparations. A positive trend was noted for efficacy in gout or hyperuricemia (elevated uric acid in the blood). However, variability in methods and metrics did not allow for an effective meta-analysis. Improvements in vascular health and blood pressure were found to be significant. Reductions in pain associated with chronic diseases such as fibromyalgia and osteoarthritis were reported but require larger trials for drawing firm conclusions. Some exploratory studies were not supported by confirmatory studies, likely due to heterogeneity in design, size, differences among test products, and duration.



Tart cherry botanical illustration from *Pomona Italiana* (1817–1839) by Giorgio Gallesio (1772–1839). Artwork courtesy of The New York Public Library

Table 1. Selected Clinical Trials with Preparations of Tart Cherry Fruit

Publication	Study Design	Interventions	Outcome
Abbott et al (2020) ⁵²	DB-RCT, crossover, N = 10 fit young men	60 mL TC juice ^a (total polyphenols not disclosed due to unrestricted diet) or placebo (cherry flavored drink with sucrose), before, immediately after, and 12 and 36 hours after a 90-minute soccer match	No between-group differences in countermovement jump height, reactive strength index, or muscle soreness.
Bakkar et al (2019) ⁵³	DB-RCT, crossover, N = 12 overweight middle-aged men	1.7 g/d TC powder ^b (456 mg total polyphenols) or placebo (glucose) for 4 weeks, followed by 4-week washout, followed by another 4 weeks of supplementation	Brachial artery flow-mediated dilation response improved and peroxiredoxin concentration increased significantly in the cherry group, suggesting enhanced recovery and protection from respiratory burst vs. placebo.
Bell et al (2014) ^{54,55}	DB-RCT, N = 16 (8/8) trained cyclists	60 mL TC concentrate ^b (547 mg anthocyanins) for 7 days with cycling simulations on days 5, 6, and 7 or placebo (fruit cordial with trace anthocyanins matched for carbohydrate content)	Markers of oxidative stress, inflammation, and muscle damage were significantly lower vs. placebo.
Bell et al (2016) ⁵⁶	DB-RCT, N = 16 (8/8) soccer players	60 mL TC concentrate ^b for 8 days or placebo (for compositions, see above)	Significantly faster recovery of performance indices and from soreness after sprint activity vs. placebo.
Brown et al (2019) ⁵⁷	DB-RCT, N = 20 (10/10) healthy females	60 mL TC concentrate ^b (composition as above) for 8 days or placebo (synthetic flavor concentrate matched for carbohydrate content)	Muscle soreness, flexibility, and function all improved significantly vs. placebo.
Chai et al (2018 and 2019) ⁵⁸⁻⁶⁰	DB-RCT, N = 37 older subjects	480 mL TC juice ^c (corresponding to 514 g of whole tart cherries) for 12 weeks or placebo (black cherry flavored Kool-Aid [®] with dextrose and fructose added)	Systolic blood pressure and LDL cholesterol were significantly lowered and cognitive abilities improved vs. placebo.
Desai et al (2018) ⁶¹	SB-RCT, cross-over, N = 11 healthy subjects	60 mL TC concentrate ^b (composition as above) for 20 days, FATMAX tests at baseline, days 5, 10, 17, and 21 or placebo (fruit cordial with trace anthocyanins matched for carbohydrate content)	No significant impact on cardio-biomarkers.
Desai et al (2020) ⁶²	SB-RCT, crossover, N = 12 subjects with metabolic syndrome	60 mL TC concentrate ^b (composition as above) for 7 days, 14-day washout, 7 days or placebo (as above)	24-h blood pressure, fasting glucose, total cholesterol, and ratio of total cholesterol and HDL improved significantly vs. placebo.
Howatson et al (2012) ⁶³	DB-RCT, crossover, N = 20 healthy volunteers	60 mL TC concentrate ^b (composition as above) for 7 days, 14-day washout, 7 days, or placebo (as above)	Melatonin levels, sleep time, and efficiency were significantly increased vs. placebo.
Johnson et al (2020) ⁶⁴	SB-RCT, N = 19 subjects with metabolic syndrome	480 mL TC juice ^d (176 mg anthocyanins) for 12 weeks, or placebo (calorie-matched without phenolics)	LDL and soluble vascular cell adhesion molecule-1 were significantly lowered vs. placebo but not vs. baseline.
Keane et al (2016) ⁶⁵	DB-RCT, crossover, N = 27 middle-aged volunteers	60 mL TC concentrate ^b , single dose, 14-day washout, single dose. Endpoints were assessed at baseline, 1, 2, 3, and 5 h after consumption	While significant changes in vascular function were observed, these did not result in improvements of mood or cognition.
Keane et al (2016) ⁶⁶	DB-RCT, crossover, N = 15 men with early hypertension	60 mL TC concentrate ^b (composition as above), single dose, 14-day washout, single dose, or placebo (fruit cordial with trace anthocyanins matched for carbohydrate content). Endpoints were assessed at baseline, 1, 2, 3, 5, and 8 h after consumption	Significant differences in concentrations of total and oxygenated hemoglobin and reduction of systolic blood pressure vs. placebo.
Keane et al (2018) ⁶⁷	DB-RCT, crossover, N = 10 trained cyclists	60 mL TC concentrate ^b (composition as above), 4 times every 3-7 days with 6-minute moderate and severe cycling exercises 1.5 hours after ingestion, or placebo (as above)	Peak power and total work were significantly higher and systolic blood pressure significantly lower vs. placebo.
Losso et al (2018) ⁶⁸	DB-RCT, crossover, N = 8 subjects with insomnia	480 mL TC juice ^c (287 mg anthocyanins) for 2 weeks, 2-week washout, 2 weeks, or placebo (juice matched for flavor)	Sleep time and efficiency and tryptophan availability increased significantly vs. placebo.
Lynn et al (2014) ⁶⁹	RCT, open label, N = 47 healthy adults	30 mL TC concentrate ^b (composition as above) daily for 6 weeks or placebo (composition not disclosed)	No effects on arterial stiffness, C-reactive protein (CRP), or risk markers for cardiovascular disease were noted.
Martin et al (2018) ⁷⁰	RCT, crossover, N = 10 overweight (n = 5) or obese (n = 5) subjects	240 mL TC juice ^e (1827 gallic acid equivalents/L) daily for 4 weeks, 2-week washout, 4 weeks, or placebo (matched for carbohydrate content)	Erythrocyte sedimentation rate decreased significantly vs. placebo, other inflammation markers decreased non-significantly or were not affected.
McCormick et al (2016) ⁷¹	DB-RCT, crossover, N = 9 fit males	90 mL TC juice ^b (composition as above) for 6 days, 5-week washout, 6 days, water-based performance tests at baseline and day 6, or placebo (matched for carbohydrate content)	No differences in inflammation markers, performance, or recovery measures were observed between groups.
Morgan et al (2019) ⁷²	DB-RCT, crossover, N = 9 trained male cyclists	TC powder ^c (equivalent to 257 mg anthocyanins) for 7 days, 2-week washout, 7 days, 4 performance test batteries following supplementation period, or placebo (dextrose)	Performance parameters were significantly improved vs. placebo.
Pigeon et al (2010) ⁷³	DB-RCT, crossover, N = 15 older adults with chronic insomnia	TC juice ^e (60 mg anthocyanins), 8 oz daily for 2 weeks, 2-week washout, 2 weeks, or placebo (black cherry flavored Kool-Aid with dextrose and fructose added)	Significant improvement in insomnia severity, but no effect on sleep latency, total sleep time, and sleep efficiency vs. placebo.
Schumacher et al (2013) ⁷⁴	DB-RCT, crossover, N = 58 non-diabetic patients with osteoarthritis of the knee	TC juice ^f (30 mg anthocyanins), 8 oz daily for 6 weeks, 1-week washout, 6 weeks, or placebo (Kool-Aid, see above)	Significant decreases of WOMAC scores and high-sensitivity CRP were observed, but not between groups.

DB = double blind; RCT = randomized controlled trial; TC = tart cherry; SB = single blind

^a Healthspan Ltd. (Guernsey, UK)

^b Cherry Active[®]; Active Edge Nutrition Ltd. (Hanworth, UK)

^c Not disclosed

^d Indian Summer, Inc. (Traverse City, Michigan, USA)

^e R.W. Knudsen (Chico, California, USA)

^f CherryPharm, Inc. (Geneva, New York, USA)

More than 60 clinical trials on tart cherry with multiple designs, interventions, and outcomes have been identified. Many of these studies can be considered preliminary due to the low number of enrolled patients. Selected trials are summarized in Table 1.

None of the trials reviewed in Table 1 reported serious adverse reactions to any of the study preparations. The safety profile of tart cherry preparations is overall favorable, and compliance was good.

ADULTERATION

One study, published in 2016, found no cherry anthocyanins in a tart cherry fruit concentrate dietary supplement product (in capsule form) that was labeled as being standardized to contain 6.8 mg anthocyanins per serving.⁷⁵ Tart cherry juice can be adulterated with other less costly juices, and, conversely, tart cherry juice may be an adulterant of more costly fruit juices. Malic acid content can be used as an indicator of whether a juice is made from tart cherry or sweet cherry.⁷⁶

SUSTAINABILITY AND FUTURE OUTLOOK

The conservation status of *P. cerasus* has not yet been assessed using the International Union for Conservation of Nature (IUCN) *Red List Categories and Criteria*. The IUCN assigns wild sweet cherry to the conservation category of least concern (LC), meaning that the species is not considered to be threatened.⁹ In 2005, an estimated 3,689 hectares (14.2 square miles) were registered for certified organic wild collection of *P. cerasus* fruits globally.⁷⁷

Three institutions are responsible for the conservation maintenance of *P. cerasus* in Turkey: the Aegean Agricultural Research Institute (Izmir), the Horticultural Research Institute (Erzincan), and the Eğirdir Horticultural Research Institute (Isparta).¹¹ Both wild and cultivated sweet cherry and tart cherry trees once covered large areas in riverbank woodlands of Azerbaijan. However, their area is decreasing, which has been attributed to

anthropogenic effects. Accessions are being maintained at the Genetic Resources Institute and the Research Institute of Horticulture and Subtropical Crops, both in Azerbaijan.⁷⁸ The Institute of Agriculture in Skopje, North Macedonia, carries out ex situ conservation of wild flora and maintains 14 varieties of *P. cerasus*.⁷⁹

Certified organic tart cherries are now produced on a commercial scale and exported into the global market by some Asian countries (especially Turkey, but also Georgia), European countries (especially Serbia), and South American countries (Chile and Bolivia).⁸⁰ The sustainability of the tart cherry raw material supply, especially from the growing number of certified organic operations, appears stable at this time. However, impacts of climate change on the tart cherry crop should be considered. According to Steele et al (2018), climate change data are showing that tart cherry trees are being exposed “to higher temperatures in summer, later onset of cold temperatures in fall, reduced chilling hours in winter, and earlier spring onset. These factors reduce yield, impair fruit quality, and, in the worst-case scenario, cause crop failure from freeze-induced blossom damage. Earlier spring onset is the most critical factor exposing growers to losses because it increases risk of bud exposure to a late hard frost or freeze event.”⁸¹ HG

References

1. Uğurtan Yılmaz K, Ercişli S, Asma B, Doğan Y, Kafkas S. Genetic relatedness in *Prunus* genus revealed by inter-simple sequence repeat markers. *HortScience*. 2009;44(2):293-297.
2. Eisenman SW. Some nomenclatural adjustments and typifications for almond species in the genus *Prunus sensu lato* (Rosaceae). *Phytotaxa*. 2015;222(3):185-198.
3. Iezzoni AF. Acquiring cherry germplasm from central and eastern Europe. *HortScience*. 2005;40(2):304-308.
4. Gabrielian E, Zohary D. Wild relatives of food crops native to Armenia and Nakhichevan. *Fl Medit*. 2004;14:5-80.
5. Hooper D, Field H. *Useful Plants and Drugs of Iran and Iraq*. Vol IX, Number 3, Publication 387. Chicago, Illinois: Field Museum of Natural History; 1937.

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6. Muminjanov H, Karagöz A, eds. *Biodiversity of Turkey. Contribution of Genetic Resources to Sustainable Agriculture and Food Systems*. Ankara, Turkey: Food and Agriculture Organization of the United Nations; 2018.
7. Marzell H. *Wörterbuch der deutschen Pflanzennamen. 2. Band*. Stuttgart/Wiesbaden: S. Hirzel Verlag/Franz Steiner Verlag; 1977.
8. Nikolić D, Milatović D, Radović A, Trajković J. Distinguishing Oblačinska sour cherry clones (*Prunus cerasus* L.) by pollen morphology. *Genetika*. 2020;52(1):187-198.
9. Rivers MC. *Prunus avium*. The IUCN Red List of Threatened Species 2017: e.T172064A50673544. <http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T172064A50673544.en> Accessed September 7, 2020.
10. Oldén EJ, Nybom N. On the origin of *Prunus cerasus* L. *Hereditas*. 1968;59(2-3):327-345.
11. Gönülşen N. *Prunus* germplasm in Turkey. In: Gass T, Tobutt KR, Zanetto A, eds. *Report of the Working Group on Prunus. Fifth meeting, 1-3 February 1996, Menemen-Izmir, Turkey*. Rome, Italy: International Plant Genetic Resources Institute; 1996:71-78.
12. UN Comtrade Database. 2020. Available at: <https://comtrade.un.org/>. Accessed September 6 2020.
13. Global Agricultural Trade System (GATS) Online. USDA Foreign Agricultural Service; 2020. Available at: <https://apps.fas.usda.gov/gats/>. Accessed September 6, 2020.
14. United States Department of Agriculture. Tart cherries grown in the states of Michigan, et al.; Free and restricted percentages for the 2019–20 crop year. Final rule. *Federal Register*. 2020;85(131):40867-40873.
15. Tournefort JP. *Institutiones Rei Herbariae, editio altera*. Vol I. Paris, France: E Typographia Regia; 1700.
16. Linné Cv, Salvius L. *Caroli Linnaei ... Species plantarum: exhibentes plantas rite cognitatas, ad genera relatas, cum differentiis specificis, nominibus trivialibus, synonymis selectis, locis natalibus, secundum systema sexuale digestas*. Vol 2. Holmiae :: Impensis Laurentii Salvii; 1753.
17. Hehn V. *Cultivated Plants and Domesticated Animals in their Migration from Asia to Europe*. London, England: Swan Sonnenschein & Co.; 1891.
18. Meyer FG. Carbonized food plants of Pompeii, Herculaneum, and the Villa at Torre Annunziata. *Econ Bot*. 1980;34(4):401-437.
19. Belfiglio VJ. Acute pain management in the Roman Army. *Anaesth Pain Intensive Care*. 2017;21(3):383-386.
20. Miller NF, Gadotti A. The KHALUB-tree in Mesopotamia: Myth or Reality? In: Fairbairn AS, Weiss E, eds. *From Foragers to Farmers: Papers in Honour of Gordon C. Hillman*. Oxford, UK: Oxbow Books; 2009:239-243.
21. Bien S, Damm U. *Prunus* trees in Germany — A hideout of unknown fungi? *Mycol Prog*. 2020;19(7):667-690.
22. Bundessortenamt. Sortenregister. *Blatt für Sortenwesen, Amtsblatt des Bundessortenamtes*. 15 April 2015; Sonderheft:86.
23. Ahmad I, Shamsi S, Zaman R. A review on sour cherry (*Prunus cerasus*): A high value Unani medicinal fruit. *Int J Green Pharm*. 2017;11(1):1-6.
24. Unani Pharmacopoeia Committee. *National Formulary of Unani Medicine — Part V*. New Delhi, India: Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and

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- Homoeopathy (AYUSH), Ministry of Health & Family Welfare, Government of India; 2008.
25. Pieroni A, Nedelcheva A, Hajdari A, et al. Local knowledge on plants and domestic remedies in the mountain villages of Peshkopia (Eastern Albania). *J Mt Sci*. 2014;11(1):180-193.
 26. Steinmetz EF. *Materia Medica Vegetabilis*. Amsterdam, Netherlands: E.F. Steinmetz; 1954.
 27. EFSA Panel on Dietetic Products Nutrition and Allergies (NDA). Scientific Opinion on the substantiation of health claims related to various food(s)/food constituent(s) and health relationships that are not sufficiently defined; are not referring to a function of the body; are related to the prevention or treatment of a disease; are not referring to a beneficial physiological effect pursuant to Article 13(1) of Regulation (EC) No 1924/2006. *EFSA J*. 2011;9(6):2228.
 28. United States Pharmacopeial Convention. *The Pharmacopeia of the United States of America, Forty-third Revision and the National Formulary, Thirty-Eighth Edition (USP 43–NF 38)*. Rockville, MD: United States Pharmacopeial Convention; 2020.
 29. United States Department of Agriculture. *United States Standards for Grades of Frozen Red Tart Pitted Cherries*. Washington, DC: US Department of Agriculture; 1974.
 30. United States Department of Agriculture. *United States Standards for Grades of Red Sour Cherries for Manufacture*. Washington, DC: US Department of Agriculture; 2016.
 31. US Food and Drug Administration. 21CFR §172.510 Natural flavoring substances and natural substances used in conjunction with flavors. In: *Code of Federal Regulations*. Washington, DC: Office of the Federal Register, National Archives and Records Administration; 2019.
 32. US Food and Drug Administration. Title 21 — Food and Drugs. Chapter I. Part 145 — CANNED FRUITS. Subpart B — Requirements for Specific Standardized Canned Fruits. In: *Code of Federal Regulations*. Washington, DC: National Archives and Records Administration; 2019.
 33. United States Department of Agriculture. 7 CFR § 205.606: Nonorganically produced agricultural products allowed as ingredients in or on processed products labeled as “organic.” In: *Code of Federal Regulations*. Washington, DC: Office of the Federal Register, National Archives and Records Administration; 2019:446-448.
 34. Office of Dietary Supplements and the National Library of Medicine. *Dietary Supplement Label Database*. Bethesda, MD: National Institutes of Health; 2020.
 35. Natural and Non-prescription Health Products Directorate. *Natural Health Products Ingredients Database*. Ottawa, Ontario: Health Canada; 2020.
 36. Natural and Non-prescription Health Products Directorate. *Natural Health Product: Antioxidants*. Ottawa, Ontario: Health Canada; 2017.
 37. European Commission. *Cosmetic ingredient (CosIng) database*. Brussels, Belgium: DG Internal Market, Industry, Entrepreneurship and SMEs; 2020.
 38. EFSA Panel on Dietetic Products Nutrition and Allergies (NDA). Scientific Opinion on the substantiation of health claims related to various food(s)/food constituent(s) claiming an increase in renal water elimination, “kidneys health,” “urinary health,” “bladder health,” “health of lower urinary tract,” “blood health,” “elimination,” “urinary system benefits” and/or “supports/promotes the excretory function of the kidney,” and treatment/prevention of renal gravel/kidney stones and urinary tract infections pursuant to Article 13(1) of Regulation (EC) No 1924/2006. *EFSA J*. 2010;8(10):1742.
 39. EFSA Panel on Dietetic Products Nutrition and Allergies (NDA). Scientific Opinion on the substantiation of health claims related to various food(s)/food constituent(s) and protection of cells from premature aging, antioxidant activity, antioxidant content and antioxidant properties, and protection of DNA, proteins and lipids from oxidative damage pursuant to Article 13(1) of Regulation (EC) No 1924/2006. *EFSA J*. 2010;8(2):1489.
 40. Cásedas G, Les F, Gómez-Serranillos MP, Smith C, López V. Bioactive and functional properties of sour cherry juice (*Prunus cerasus*). *Food Funct*. 2016;7(11):4675-4682.
 41. Tiernan C, Imrhan V, Prasad C, Vijayagopal P, Juma S. Tart cherry in amelioration of pain in the elderly. *Nutr Aging*. 2015;3:203-217.
 42. Kelley DS, Adkins Y, Laugero KD. A review of the health benefits of cherries. *Nutrients*. 2018;10(3):368.
 43. Santos HO, Genario R, Gomes GK, Schoenfeld BJ. Cherry intake as a dietary strategy in sport and diseases: a review of clinical applicability and mechanisms of action. *Crit Rev Food Sci Nutr*. 2020:1-14.
 44. Mayta-Apaza AC, Daya M, Franck C. Tart Cherries and health: Current knowledge and need for a better understanding of the fate of phytochemicals in the human gastrointestinal tract. *Crit Rev Food Sci Nutr*. 2019;59(4):626-638.
 45. Seymour EM, Warber SM, Kirakosyan A, et al. Anthocyanin pharmacokinetics and dose-dependent plasma antioxidant pharmacodynamics following whole tart cherry intake in healthy humans. *J Funct Foods*. 2014;11:509-516.
 46. Doma K, Gahreman D, Connor J. Fruit supplementation reduces indices of exercise-induced muscle damage: a systematic review and meta-analysis. *Eur J Sport Sci*. 2020:1-18.
 47. Gao R, Chilibeck PD. Effect of tart cherry concentrate on endurance exercise performance: A meta-analysis. *J Am Coll Nutr*. 2020:1-8.
 48. Vlachojannis J, Weber C, Zimmermann BF, Chrubasik-Hausmann S. Wirksamkeit der Montmorency-Sauerkirsche bei sportlicher Aktivität. *Z Phytother*. 2020;41(01):18-26.
 49. Chen P-E, Liu C-Y, Chien W-H, Chien C-W, Tung T-H. Effectiveness of cherries in reducing uric acid and gout: A systematic review. *Evid Based Complement Alternat Med*. 2019;2019:9896757.
 50. Fairlie-Jones L, Davison K, Fromentin E, Hill AM. The effect of anthocyanin-rich foods or extracts on vascular function in adults: A systematic review and meta-analysis of randomised controlled trials. *Nutrients*. 2017;9(8):908.
 51. Han B, Srikanth Bhagavathula A, Rashid M, et al. The effect of sour cherry consumption on blood pressure, IL-6, CRP, and TNF- α levels: A systematic review and meta-analysis of randomized controlled trials sour cherry consumption and blood pressure. *J King Saud Univ Sci*. 2020;32(2):1687-1693.
 52. Abbott W, Brashill C, Brett A, Clifford T. Tart cherry juice: No effect on muscle function loss or muscle soreness in professional soccer players after a match. *Int J Sports Physiol Perform*. 2020;15(2):249.

Sustainable Herbs Program

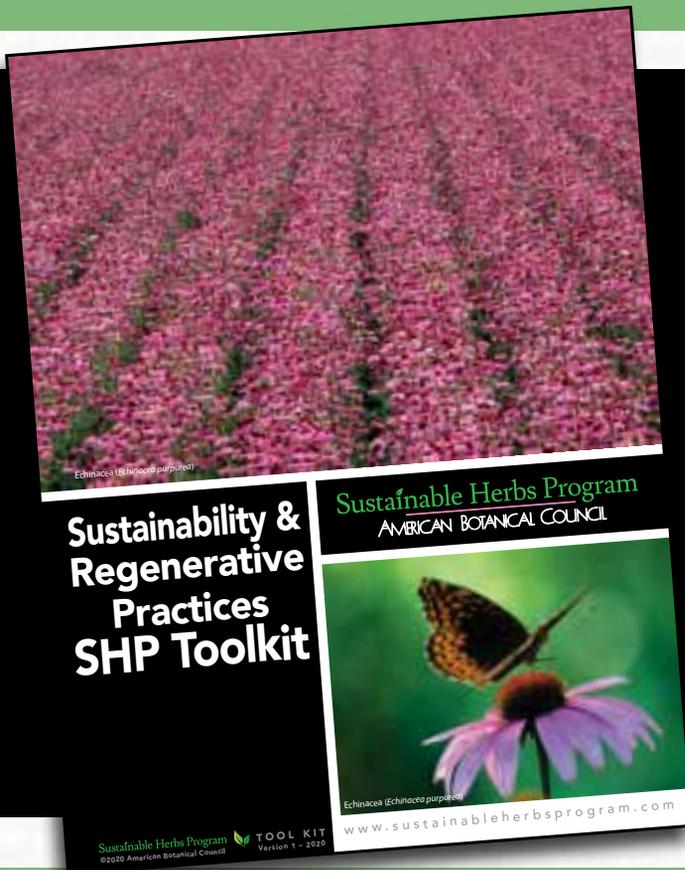
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53. Bakkar ZA, Fulford J, Gates PE, et al. Montmorency cherry supplementation attenuates vascular dysfunction induced by prolonged forearm occlusion in overweight, middle-aged men. *J Appl Physiol*. 2019;126(1):246-254.
54. Bell PG, Walshe IH, Davison GW, Stevenson E, Howatson G. Montmorency cherries reduce the oxidative stress and inflammatory responses to repeated days high-intensity stochastic cycling. *Nutrients*. 2014;6(2):829-843.
55. Bell PG, Walshe IH, Davison GW, Stevenson EJ, Howatson G. Recovery facilitation with Montmorency cherries following high-intensity, metabolically challenging exercise. *App Physiol Nutr Metab*. 2014;40(4):414-423.
56. Bell PG, Stevenson E, Davison GW, Howatson G. The Effects of Montmorency tart cherry concentrate supplementation on recovery following prolonged, intermittent exercise. *Nutrients*. 2016;8(7):441.
57. Brown MA, Stevenson EJ, Howatson G. Montmorency tart cherry (*Prunus cerasus* L.) supplementation accelerates recovery from exercise-induced muscle damage in females. *Eur J Sport Sci*. 2019;19(1):95-102.
58. Chai SC, Davis K, Wright RS, Kuczumski MF, Zhang Z. Impact of tart cherry juice on systolic blood pressure and low-density lipoprotein cholesterol in older adults: a randomized controlled trial. *Food Funct*. 2018;9(6):3185-3194.
59. Chai SC, Davis K, Zhang Z, Zha L, Kirschner KF. Effects of tart cherry juice on biomarkers of inflammation and oxidative stress in older adults. *Nutrients*. 2019;11(2):228.
60. Chai SC, Jerusik J, Davis K, Wright RS, Zhang Z. Effect of Montmorency tart cherry juice on cognitive performance in older adults: A randomized controlled trial. *Food Funct*. 2019;10(7):4423-4431.
61. Desai T, Bottoms L, Roberts M. The effects of Montmorency tart cherry juice supplementation and FATMAX exercise on fat oxidation rates and cardio-metabolic markers in healthy humans. *Eur J Appl Physiol*. 2018;118(12):2523-2539.
62. Desai T, Roberts M, Bottoms L. Effects of short-term continuous Montmorency tart cherry juice supplementation in participants with metabolic syndrome. *Eur J Nutr*. 2020.
63. Howatson G, Bell PG, Tallent J, Middleton B, McHugh MP, Ellis J. Effect of tart cherry juice (*Prunus cerasus*) on melatonin levels and enhanced sleep quality. *Eur J Nutr*. 2012;51(8):909-916.
64. Johnson SA, Navaei N, Pourafshar S, et al. Effects of Montmorency tart cherry juice consumption on cardio-metabolic biomarkers in adults with metabolic syndrome: A randomized controlled pilot trial. *J Med Food*. 2020.
65. Keane KM, Haskell-Ramsay CF, Veasey RC, Howatson G. Montmorency tart cherries (*Prunus cerasus* L.) modulate vascular function acutely, in the absence of improvement in cognitive performance. *Brit J Nutr*. 2016;116(11):1935-1944.
66. Keane KM, George TW, Constantinou CL, Brown MA, Clifford T, Howatson G. Effects of Montmorency tart cherry (*Prunus cerasus* L.) consumption on vascular function in men with early hypertension. *Am J Clin Nutr*. 2016;103(6):1531-1539.
67. Keane KM, Bailey SJ, Vanhatalo A, Jones AM, Howatson G. Effects of Montmorency tart cherry (*Prunus cerasus*) consumption on nitric oxide biomarkers and exercise performance. *Scan J Med Sci Sports*. 2018;28(7):1746-1756.
68. Lusso JN, Finley JW, Karki N, et al. Pilot study of the tart cherry juice for the treatment of insomnia and investigation of mechanisms. *Am J Ther*. 2018;25(2):e194-e201.
69. Lynn A, Mathew S, Moore CT, et al. Effect of a tart cherry juice supplement on arterial stiffness and inflammation in healthy adults: A randomised controlled trial. *Plant Foods Hum Nutr*. 2014;69(2):122-128.
70. Martin KR, Burrell L, Bopp J. Authentic tart cherry juice reduces markers of inflammation in overweight and obese subjects: A randomized, crossover pilot study. *Food Funct*. 2018;9(10):5290-5300.
71. McCormick R, Peeling P, Binnie M, Dawson B, Sim M. Effect of tart cherry juice on recovery and next day performance in well-trained water polo players. *J Int Soc Sports Nutr*. 2016;13(1):41.
72. Morgan PT, Barton MJ, Bowtell JL. Montmorency cherry supplementation improves 15-km cycling time-trial performance. *Eur J Appl Physiol*. 2019;119(3):675-684.
73. Pigeon WR, Carr M, Gorman C, Perlis ML. Effects of a tart cherry juice beverage on the sleep of older adults with insomnia: A pilot study. *J Med Food*. 2010;13(3):579-583.
74. Schumacher HR, Pullman-Mooar S, Gupta SR, Dinnella JE, Kim R, McHugh MP. Randomized double-blind crossover study of the efficacy of a tart cherry juice blend in treatment of osteoarthritis (OA) of the knee. *Osteoarthritis Cartilage*. 2013;21(8):1035-1041.
75. Lee J. Rosaceae products: Anthocyanin quality and comparisons between dietary supplements and foods. *NFS J*. 2016;4:1-8.
76. Dasenaki ME, Thomaidis NS. Quality and authenticity control of fruit juices — A review. *Molecules*. 2019;24:1014.
77. Censkowsky U, Helberg U, Nowack A, Steidle M. *Overview of World Production and Marketing of Organic Wild Collected Products*. Geneva, Switzerland: International Trade Centre UNCTAD/WTO; 2007.
78. Government of Azerbaijan. *National Report on the State of Plant Genetic resources for Food and Agriculture in Azerbaijan*. Baku, Azerbaijan: Food and Agriculture Organization of the United Nations (FAO) Partnership and Liaison Office in the Republic of Azerbaijan; 2006.
79. Smith RD, Smith KA, eds. *Country Study for Biodiversity of the Republic of Macedonia (First National Report)*. Skopje, North Macedonia: Ministry of Environment and Physical Planning; 2003.
80. United States Department of Agriculture. *Organic INTEGRITY Database*. Washington, DC: USDA Agricultural Marketing Service; 2020.
81. Steele C, Reyes J, Elias E, Aney S, Rango A. Cascading impacts of climate change on southwestern US cropland agriculture. *Clim Change*. 2018;148(3):437-450.

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ADOPT-AN-HERB

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P R O G R A M

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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Herbal Adopters

	Oat <i>Avena sativa</i>		Senna <i>Senna alexandrina</i>
	Milk Thistle <i>Silybum marianum</i>		Black Chokeberry <i>Aronia melanocarpa</i>
	Fig <i>Ficus carica</i>		Elderberry <i>Sambucus nigra</i>
	Yerba Maté <i>Ilex paraguariensis</i>		Stinging Nettle <i>Urtica dioica</i>
	Helichrysum <i>Helichrysum italicum</i>		Echinacea <i>Echinacea spp.</i>
	Saffron <i>Crocus sativus</i>		Cranberry <i>Vaccinium macrocarpon</i>
	EpiCor® Fermentate <i>Saccharomyces cerevisiae</i>		Lemon Balm <i>Melissa officinalis</i>
	Rhodiola <i>Rhodiola rosea</i>		Broccoli <i>Brassica oleracea</i> Broccoli Group
	Garlic <i>Allium sativum</i>		Tea Tree <i>Melaleuca alternifolia</i>
	Artichoke <i>Cynara cardunculus</i> Scolymus Group		Peppermint <i>Mentha x piperita</i>
	Baobab <i>Adansonia digitata</i>		Aloe Vera <i>Aloe vera</i>
	Rooibos <i>Aspalathus linearis</i>		Maca <i>Lepidium meyenii</i>
	Propolis		Turmeric <i>Curcuma longa</i>
YOUR LOGO	Plant name <i>Scientific name</i>	YOUR LOGO	Plant name <i>Scientific name</i>

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Herbal Adopters

NEW ADOPTER!		NEW ADOPTER!	
	Japanese Sophora <i>Styphnolobium japonicum</i>		Shatavari <i>Asparagus racemosus</i>
	Monk Fruit <i>Siraitia grosvenorii</i>		Andrographis <i>Andrographis paniculata</i>
	Indian Frankincense <i>Boswellia serrata</i>		Licorice <i>Glycyrrhiza spp.</i>
	Rose Hip <i>Rosa canina</i>		Tart Cherry <i>Prunus cerasus</i>
	Notoginseng <i>Panax notoginseng</i>		Black Currant <i>Ribes nigrum</i>
	Lifeflower <i>Erigeron breviscapus</i>		Purple Corn <i>Zea mays</i>
	Asian Ginseng <i>Panax ginseng</i>		Chamomile <i>Matricaria chamomilla</i>
	Lavender <i>Lavandula angustifolia</i>		Rough Horsetail <i>Equisetum hyemale</i>
	Pomegranate <i>Punica granatum</i>		Saw Palmetto <i>Serenoa repens</i>
	Ashwagandha <i>Withania somnifera</i>		Arnica <i>Arnica montana</i>
	Hibiscus <i>Hibiscus sabdariffa</i>		Coffee Fruit <i>Coffea spp.</i>
	Bacopa <i>Bacopa monnieri</i>		Guayusa <i>Ilex guayusa</i>
	Ginkgo <i>Ginkgo biloba</i>		Hops <i>Humulus lupulus</i>
	Kesum <i>Persicaria minor</i>		Birch <i>Betula spp.</i>
	Tongkat Ali <i>Eurycoma longifolia</i>		Olive <i>Olea europaea</i>
	Acerola <i>Malpighia spp.</i>		Grape <i>Vitis vinifera</i>
	Sceletium <i>Sceletium tortuosum</i>		Devil's Claw <i>Harpagophytum spp.</i>

Maca and Andrographis Adoptions Support ABC's Adopt-an-Herb Program

By Connor Yearsley and Tyler Smith

The American Botanical Council (ABC) welcomes the adoptions of maca (*Lepidium meyenii*, Brassicaceae) by Symphony Natural Health and andrographis (*Andrographis paniculata*, Acanthaceae) by Natural Remedies through ABC's Adopt-an-Herb botanical research and education program.

These adoptions support ABC's extensive HerbMedPro database, ensuring that this unique research and educational 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 265 herbs, spices, medicinal plants, and fungi.

Symphony Natural Health Adopts Maca

"We could think of no herb other than maca that is more ideal for our company to adopt," said James Frame, CEO of Symphony Natural Health. "Maca is the core ingredient in half of our product line, we have been researching the plant for more than 20 years, and we have exported thousands of tons of maca around the world from our operation in Peru, controlling the whole process from seed to shelf.

"Since 1999, our director of research and development, Dr. Henry Meissner, has conducted extensive clinical research on maca and its effects in women," Frame added. "To promote maca and its health benefits around the world, he has collaborated with Dr. Gloria Chacón, who is regarded as the 'Mother of Maca,' and Dr. Gustavo Gonzales, who has conducted extensive research on maca and its effects in men."

Symphony Natural Health's "why," or purpose, is to be conscious, lead, and empower, according to Frame. That includes providing optimal health solutions, leading by example, creating trends instead of following them, and offering products supported by clinical trial results. "Supporting a leader like ABC through the Adopt-an-Herb program helps empower our industry with the latest information about maca, which is perfectly aligned with our 'why,'" Frame said.

"We hope that with this adoption, the industry will recognize that there are, in fact, different phenotypes [observable characteristics or traits] of maca," Frame added. "By illustrating that these phenotypes can be different colors and have different DNA, analytical profiles, and physiological effects in the body, we can then ensure that when people consider using maca, they can assess what would be the best phenotype or combination of phenotypes."

ABC Chief Science Officer Stefan Gafner, PhD, said: "ABC highly appreciates the adoption of maca by Symphony Natural Health, which allows the published science on this important plant to be made available to a broader audience via ABC's HerbMedPro database. Unfortunately, maca has

become an example of a medicinal plant for which biopiracy [the illegal export of maca and establishment of large cultivations in China] has deprived producers in Peru, where the plant is native, of fair compensation. As such, we applaud Symphony Natural Health for its long-standing commitment to Peruvian-grown maca and supporting the plant's health benefits with scientific research."

About Maca

Maca is an herbaceous biennial plant in the *Lepidium* genus, which is one of the largest genera in the mustard or cabbage family (Brassicaceae). It resembles a radish (*Raphanus raphanistrum* subsp. *sativus*, Brassicaceae) and is the only species in its genus with a fleshy, starchy subterranean storage part called a hypocotyl, which is fused with the taproot and is the part of the plant that is used most often. The species is native to plateaus of the central Andes at altitudes up to about 4,500 meters (14,764 feet), in habitats that are intensely cold with extreme sunlight and wind.

For centuries, native Peruvians, including the Inca, have used maca as a vital dietary staple and traditional medicine. It probably was domesticated in present-day Ondores, Junín, Peru, about 1,300 to 2,000 years ago. Traditionally, the hypocotyls are dried and can be stored for many years. Maca reportedly often was traded for lowland foods, including cassava (*Manihot esculenta*, Euphorbiaceae), corn (*Zea mays*, Poaceae), papaya (*Carica papaya*, Caricaceae), quinoa (*Chenopodium quinoa*, Amaranthaceae), and rice (*Oryza sativa*, Poaceae).

In 1553, Cieza de León, a Spanish conquistador and chronicler of Peru, provided the first known description of maca and noted that Peruvian highland natives used the plant to maintain health. In the 17th century, Padre Bernabé Cobo, a Spanish Jesuit missionary, described the plant's name and noted that it grows in the coldest and harshest areas of Chinchaycocha, where no other plants for sustenance could grow.

Some sources consider maca to be adaptogenic (i.e., it may increase the state of non-specific resistance to stress), and it may have antimicrobial, antioxidant, hepatoprotective, immunomodulatory, and neuroprotective effects. It may also have benefits for anxiety, benign prostatic hyperplasia, energy, libido, mood, osteoporosis, reproductive function, and more. However, more human studies that evaluate individual phenotypes and combinations of phenotypes are needed to confirm some of these potential benefits, because many of these potential benefits have been attributed to only one phenotype, according to Frame.



Maca *Lepidium meyenii*
Photo ©2020 Steven Foster

Maca has high nutritional value and contains starch, dietary fiber, protein, and lipids. Glucosinolates are also important constituents of maca. Traditionally, before consumption, maca often is boiled to produce a juice, which seems to increase the contents of and the body's ability to digest some active metabolites. However, Frame noted that the heating also has been shown to destroy some potential active constituents.

About Symphony Natural Health

Natural Health International was founded in 1997 and was rebranded as Symphony Natural Health in 2018. The company is based in Utah and has operations in Australia, France, Peru, the United States, and Vanuatu. Symphony Natural Health's vision is to form and support a synergistic "symphony" within the body and also among the communities with which it partners, and the environment in which it works, to promote harmony and health.

Symphony Natural Health's products are all organic, vegan, and kosher certified and free of extractives, alcohol, additives, colorings, preservatives, silicon dioxide, magnesium stearate, gluten, dairy, soy, and corn, according to the company. Finished capsules are packed in oxygen- and moisture-protected blister packs and in boxes made from recycled fibers printed with vegetable ink.

All the company's operations in developing countries are either joint ventures with local people or completely locally employed, according to its website. The company uses customized growing, harvesting, and proprietary manufacturing processes for each herb, depending on



Maca
Lepidium meyenii

what is best for its chemistry and biology. For more information, visit symphonynaturalhealthpro.com.

Natural Remedies Adopts Andrographis

"We are happy to be associated with ABC by adopting *Andrographis paniculata*, one of the best-known medicinal plants for immunity and inflammation in the Ayurvedic system," said Deepak Mundkinajeddu, PhD, head of research and development at Natural Remedies. "Scientific publications on this plant have risen significantly during [the past] decade, covering various aspects such as clinical studies, mechanisms of action, and agronomy research.

"AP-Bio[®], also known as KalmCold[®], is derived from andrographis and is clinically tested for its immunomodulatory and anti-inflammatory properties," Mundkinajeddu added, referring to his company's proprietary andrographis extract. "It is time to spread knowledge on the plant's immune health benefits as customers explore various natural immune health solutions."

Gafner said: "We are deeply grateful to Natural Remedies for its adoption of andrographis. Data from human clinical studies support the therapeutic benefits of andrographis in patients with acute upper respiratory tract infections. The support from Natural Remedies will enable ABC to keep up with the scientific and clinical literature on andrographis in our HerbMedPro database and will make scientific information on this useful medicinal plant more easily available."

About Andrographis

Andrographis is a small annual plant that is native to southern Asian countries, including India, Pakistan, Bangladesh, and Sri Lanka. Also known as the king of bitters, *kiryata* (or *kirayat*) in Hindi, and *chuan xin lian* (“thread-the-heart lotus”) in Chinese, the herb is widely used in Asian traditional medicine systems, especially as a treatment for infectious diseases and digestive disorders.

In Ayurveda, the primary traditional medical system of India, the dried leaves and shoots of andrographis are used in formulations to treat bronchitis, cough, diarrhea, dyspepsia, fever, inflammation, and skin diseases, among other conditions. In traditional Chinese medicine, the herb has been used to treat colitis, cough, dysentery, fever, influenza, sore throat, and venomous snake bites.

Andrographis also is used as a substitute for chirata (*Swertia* spp., Gentianaceae), an overexploited herb in the northern Himalayas with similar therapeutic properties. In addition, andrographis has been investigated as an ethical alternative to bear bile, which is a common ingredient in traditional medicine formulas in some parts of Asia.

In vitro and animal studies have found that andrographis has anti-inflammatory, antimicrobial, antioxidant, and antitumor properties. Modern research on andrographis has focused largely on its use for respiratory and digestive conditions. Results from human clinical trials and meta-analyses suggest that andrographis preparations may be

useful for treating upper-respiratory symptoms associated with cold and flu, and for reducing the frequency and severity of cough. Researchers also have investigated the use of andrographis for rheumatoid arthritis and ulcerative colitis.

About Natural Remedies

Natural Remedies Pvt. Ltd. is a global, research-driven, botanical health care company based in Bengaluru, India, whose core competency lies in manufacturing standardized herbal extracts. According to the company, its mission is to harness nature and apply science for health and happiness. The company states that its branded ingredients are clinically substantiated and scientifically validated innovations. Known as a leader in standardized botanical extracts, Natural Remedies has contributed to the development of monographs on Indian botanicals in various international pharmacopeias. The company also has been a leading producer and global supplier of high-purity phytochemical reference standards for quality control analyses and research on Indian medicinal plants.

In addition to its adoption of andrographis, Natural Remedies is also the adopter of licorice (*Glycyrrhiza* spp., Fabaceae) through ABC’s Adopt-an-Herb program.

About Adopt-an-Herb and HerbMedPro

Symphony Natural Health and Natural Remedies are among the 65 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 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, 72 herbs have been adopted.

Each adopted herb is researched continuously for new scientific articles and 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 general public at no cost, with access to 25-30 herb records from the larger HerbMedPro database. In keeping with ABC’s position as an independent research and education organization, herb adopters do not influence the scientific information that is compiled for their respective adopted herbs. HG

Andrographis *Andrographis paniculata*
Photo ©2020 Steven Foster



naturalTM
R E M E D I E S

Andrographis

Andrographis paniculata

Prolific HerbClip Author Heather Oliff Retires after 21 Years

By Hannah Bauman

Heather Oliff, PhD, has written about six HerbClip™ articles per month for the American Botanical Council (ABC) since 1999. In August 2020, she wrote her final HerbClip as a regular contributor.

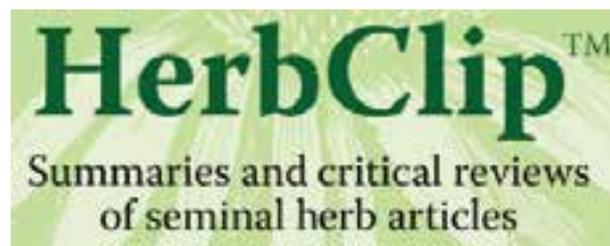
“For the past 20 years I have regularly thought, ‘It’s time to write that HerbClip!’” Oliff said (oral communication, August 25, 2020). “Now that I don’t have to do that, [it will be] odd.”

A valuable resource for scientists, researchers, health professionals, industry members, and others, HerbClips are two- to three-page summaries and critical reviews of scientific journal articles that cover medicinal plant-related human clinical research, analytical methods, regulatory data, market information, ethnobotanical reviews, conservation and sustainability studies, and more. While about one-fifth of the entire database of HerbClips is available to the public, all HerbClips are available to ABC members at the Academic level and above. When possible, the original article summarized in the HerbClip is also available to download. New HerbClips are issued twice monthly, generally in batches of 16, and according to HerbClip Managing Editor Lori Glenn, 8,052 HerbClips were available online as of August 31, 2020. Oliff estimates that she has written 1,550 HerbClips, or almost 20% of the total number.

Selected HerbClips are subjected to an additional round of peer review and editing for publication as Research Reviews in *HerbalGram*, ABC’s quarterly, peer-reviewed journal. Oliff’s first Research Review was published in *HerbalGram* issue 53 in 2001; to date, she has authored 128 articles for *HerbalGram*.



Heather Oliff



After earning her doctorate in pharmacology and toxicology from the University of California, Irvine and working in post-doctoral research, Oliff formed her own company, Scientific Consulting Group, LLC (SCG), in 1999 and began medical writing full time. ABC was her longest consistent client since she founded SCG.

“I’m fortunate at this point in my career to be very busy,” Oliff said of her decision to end her contract with ABC. “It’s a bittersweet farewell. On one hand, I’m looking forward to spending more time with my family. On the other, it’s like something is missing.”

When Oliff began writing HerbClip articles, the process was analog and done through the US Postal Service. Authors received printed copies of the articles and sent in their drafts through the mail. Members received hard copies of the HerbClip summaries. The first electronic HerbClips were sent out in 2007 and the entire process moved online in 2009.

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Regardless of the format, Oliff appreciated the variety of articles that HerbClip authors received for review and said that being an HerbClip author gave her a competitive edge in her medical writing business.

“It helped me stay up on the current literature because I would have to read articles all the time, and it broadened my knowledge base, not just for herbs but for therapeutic conditions,” Oliff said. “Lori or previous managing editors would send me articles, and it didn’t matter if it was cardiovascular or dermatological. This enabled me to have a larger breadth of knowledge compared to other medical writers who try to focus on one area.” However, in general, Oliff says that the areas she is most passionate about are neurological diseases.

In addition to her expansive knowledge of various herbs and conditions, Oliff said her biggest takeaways from her years as an HerbClip author were the work of the ABC-AHP-NCNPR Botanical Adulterants Prevention Program (BAPP) and the amount of ongoing research on herbs. The impact of herbal research, she said, influenced her as both a consumer and a scientist.

The amount of quality research submitted for review initially surprised Oliff. “It’s great that so much research is ongoing,” she said. “There’s definitely a future in plant-based medicine. A lot of people automatically assume that there isn’t any research in this area, so I like having that knowledge.”

Glenn joked that she is in “denial” about Oliff’s retirement (email, September 3, 2020). “When I began working at ABC 18 years ago, Heather was already a seasoned writer. During these nearly two decades, she has not only consistently produced quality critical reviews and summaries but has become a friend. Whether it’s been sharing the joys of her two daughters’ accomplishments as they’ve grown up or the discovery of our similar taste in music, there has been ‘a whole lot of history,’ and I will sorely miss her.”

Moving forward, Oliff will continue medical writing, but with a lessened (“Just a little bit lessened!” she clarified) workload, which will allow her to spend more time with her husband and two daughters. However, she wants to leave the door open for future projects with ABC, such as product-specific monographs. Recently, in 2019, Oliff authored ABC’s updated product-specific monograph on Pycnogenol® (Horphag Research; Geneva, Switzerland), a proprietary extract of French maritime pine bark (*Pinus pinaster* subsp. *atlantica*, Pinaceae). And perhaps, once she has truly retired, she will start writing HerbClips again for fun.

ABC Founder and Executive Director Mark Blumenthal commented: “Heather has been a truly remarkable and valuable asset to ABC for 21 years. She has done excellent work, and her drafts usually require relatively little editing. Her amazing efforts are contributions to the herbal medicine community at large. Imagine writing more than 1,500 research summaries — an astonishing feat! While we are sorry to lose her as an HerbClip writer, we are deeply grateful that she will continue to work with ABC on special publications.”

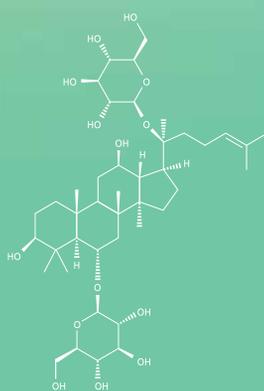
Oliff concluded: “I am sad to be closing this chapter of my life. ABC has been an important part of my life and my business. I enjoyed ... being part of the herbal community. It’s sad to say goodbye.” HG



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Botanical Adulterants Prevention Program Publishes Bulletin on Milk Thistle Extract

Bulletin summarizes reports of milk thistle fruits and extracts from which substantial amounts of active compounds have been removed

By ABC Staff

The ABC-AHP-NCNPR Botanical Adulterants Prevention Program (BAPP) announces the publication of a new Botanical Adulterants Prevention Bulletin (BAPB) on milk thistle (*Silybum marianum*, Asteraceae) fruit.

Dietary supplements and herbal medicinal products made from the extracts of milk thistle fruit (sometimes called seed) are widely used by consumers for the supportive treatment of the liver (including alcohol- or drug-induced hepatitis and cirrhosis) and the treatment of dyspepsia and gallstones. Milk thistle dietary supplements consistently have ranked among the 40 top-selling ingredients in US natural and mainstream retail outlets over the past several decades.

The therapeutic benefits of milk thistle fruit extracts mainly result from their silymarin content. Silymarin is a collective term denoting a mixture of chemicals known as flavonolignans. Silymarin content standardization for milk

thistle extracts is well defined in official monographs, such as those published in European and US pharmacopeias.

Many peer-reviewed publications have shown that the silymarin content in some commercial dietary supplements is much lower than the amounts claimed on the product labels. To some extent, such discrepancies can be explained by the use of different analytical methods, such as the use of high-performance liquid chromatography with ultraviolet detection (HPLC-UV) rather than spectrophotometric methods (e.g., via ultraviolet or visible light spectroscopy). However, published data also point to the market occurrence of fraudulent products wherein silymarin has been reduced or removed without the knowledge of the buyer.

The new bulletin was written by Allison McCutcheon, PhD, an expert in herbal medicine research in Vancouver, British Columbia. It summarizes the published data on quality issues with milk thistle extracts, details analytical methods to detect adulteration, and describes the nomenclature, production, and market importance of milk thistle extracts. Twenty-seven medicinal plant experts from academia, government, contract analytical laboratories, analytical equipment manufacturers, and the botanical dietary supplement industry provided input on the bulletin before publication.

Stefan Gafner, PhD, chief science officer of the nonprofit American Botanical Council (ABC) and technical director of BAPP, commented: “This is the first BAPP bulletin that focuses on the sale of depleted extracts, in which beneficial constituents are knowingly removed from concentrated standardized extracts, and the remaining botanical material is resold without declaring that important, therapeutically-active plant chemicals are absent, or present at very low concentrations.”

Gafner continued: “Such practices are known to occur in the spice industry, for example with black pepper [*Piper nigrum*, Piperaceae], from which the pungent compounds sometimes are extracted and sold to the flavor industry, while the extracted peppercorns are dried, mixed with genuine peppercorns, and sold to the spice industry simply as ‘black pepper.’ Similarly, in the case



Adulteration of Milk Thistle
(*Silybum marianum*)

By Allison McCutcheon, PhD

American Botanical Council, Austin, TX 78723, USA
Correspondence: email

Citation (JAMA style): McCutcheon A. Adulteration of milk thistle (*Silybum marianum*). Botanical Adulterants Prevention Bulletin. Austin, TX: ABC-AHP-NCNPR Botanical Adulterants Prevention Program; 2020.

Keywords: Adulterant, adulteration, milk thistle, *Silybum marianum*, silymarin, silybin, silychristin, silydianin

Goal: The goal of this bulletin is to provide timely information on issues of adulteration of milk thistle (*Silybum marianum*, Asteraceae) fruit and its extracts to the international herbal industry and extended natural products community in general, by presenting data on the type and occurrence of adulteration, the market situation, and consequences for the consumer and the industry.

1. General Information

1.1 Common name: Milk thistle¹

1.2 Other common names:

English:³⁻⁵ Mary's thistle, blessed milk thistle, spotted milk thistle,² bull thistle, gundagai thistle, holy thistle, lady's thistle, variegated artichoke, variegated milk thistle,³ St. Mary's thistle

Arabic:^{3,4} shawk el-gamal (also written as shuk aljamal) (شوك الجمل), shuk al-halib (شوك الحليب), alsalabayn almurimi (السلبان المريمي)

Armenian:⁵ kat' ughtap'ush

Chinese:⁵ nai ji (奶薊), shui fei ji (水飛薊)

Danish:^{5,6} marietidsel, mælk tidsel

Dutch:⁶ mariatistel



Milk Thistle *Silybum marianum*
Photo ©2020 Steven Foster

Finnish:⁶ maarianoh dake, hedelmä

French:^{3,7,8} chardon argenté, chardon Marie, lait de Notre Dame, silybe de Marie, chardon Notre Dame, épine blanche

German:^{3,8} Mariendistel, Frauendistel

Greek: gaidouráinkatho gála (γαϊδουράγκαθο γάλα)

Hebrew:⁵ g'dilan mazui

Hindi:⁵ dugdh rom

Italian:^{6,7} cardo mariano, cardo di Maria

Japanese:⁵ oozami (オオアザミ), mariaazami (マリアアザミ)

Norwegian:⁶ marietistel

Pharmacopoeial:⁸ fructus silybi Mariae, fructus cardui Mariae

Polish:⁶ ostropest plamisty

Portuguese:³ cardo-leiteiro

Russian:⁵ ostro-pestro (остро-пестро), rastoropsha pyatnistaja (расторопша пятилистная)

Spanish:^{3,7} cardo de María, cardo lechero, cardo mariano, cardo asnal, cardo blanco, cardo santo, poma

Swedish:³ mariatistel

Milk Thistle *Silybum marianum* - Botanical Adulterants Prevention Bulletin • October 2020 • www.botanicaladulterants.org

1

of milk thistle, the extracted silymarin complex can be sold at higher prices to the phytomedicinal and dietary supplement industry, while the leftover spent milk thistle fruits might be re-extracted, and those depleted extracts or fruits might be sold to unsuspecting buyers.”

Mark Blumenthal, ABC founder and executive director and BAPP founder and director, said: “Due to its clinically documented safety and beneficial activity, milk thistle has become a popular phytomedicine and herbal dietary supplement, mainly among people who are using it to improve and/or maintain liver health. In some cases, people with compromised liver function might continue to experience liver problems if the milk thistle product they are taking contains adulterated material, particularly when all or most of the primary beneficial compounds have been removed.”

The goal of the BAPBs is to provide accounts of ongoing issues related to botanical identity and adulteration and provide confirmation of the suspected adulteration of botanical raw materials, extracts, and essential oils, as well as fungal preparations. This allows quality control personnel and lab technicians in the herbal medicine, botanical ingredient, dietary supplement, cosmetic, conventional food, and other industries where botanical and fungal

ingredients are used to be informed about adulteration problems that are apparently widespread and/or that may imply safety concerns.

The milk thistle bulletin is the 22nd BAPB and the 61st peer-reviewed BAPP publication. As with all BAPP publications, the bulletins are freely accessible to all ABC members, registered users of the ABC website, and members of the public on the BAPP website (registration required).

About the ABC-AHP-NCNPR Botanical Adulterants Prevention Program

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



Milk thistle *Silybum marianum*
Photo ©2020 Steven Foster

ABC and SHP Launch Webinar Series Focusing on Sustainability, Ethnobotany, and Plants in Commerce

By ABC Staff

In August 2020, the American Botanical Council's (ABC's) Sustainable Herbs Program (SHP) announced a new series of free webinars as part of the SHP Sustainability and Regenerative Practices Toolkit, a collection of resources and best practices for the botanical industry. Since then, largely due to the success of the first webinars, the SHP webinar series has evolved into a joint ABC-SHP webinar program with three tracks or series: the original SHP Toolkit series, an Ethnobotany series, and a Plants in Commerce series.

The SHP Toolkit series of webinars, moderated by SHP Director Ann Armbrrecht, PhD, features conversations with experts in botanical sustainability and related fields. As of early October 2020, there have been three SHP Toolkit webinars: "Personal Wellness for Young Adults in the Time of COVID" with Tieraona Low Dog, MD, an internationally recognized integrative medicine physician, author, and educator; "Botanical Supply Sustainability in the Time of COVID" with Loren Israelsen, president of the United Natural Products Alliance, Angela McElwee, president and CEO of Gaia Herbs, and Ajay Patel, founder and CEO of Verdure Sciences; and "The Business Case for Sustainability" with Andrea Zangara, head of scientific marketing at Euromed, and Brian Zapp, creative director at Applied Food Sciences.

Two new webinars in the SHP Toolkit series have been scheduled: "Leadership and Mission: Creating a Culture of Sustainability and Regeneration" with Sebastian Pole,



co-founder of Pukka Herbs, and Tal Johnson, CEO of Herb Pharm (November 19, 2020); and "Paths to Regenerative Farming in the Botanical Industry" with representatives from Gaia Herbs, Herb Pharm, and Mega Foods (December 3, 2020).

"I have been thrilled with the richness of the conversations that have been possible through this webinar series," said Armbrrecht. "We have also been able to reach a far wider and more diverse audience

than would ever be possible at in-person events, which is exciting as well."

Armbrrecht also publishes related articles with more information and extended conversations with the webinar speakers on SHP's blog. Links to these articles and descriptions of past and planned webinars can be found on SHP's website.

Webinars in the Ethnobotany series "explore themes of plants, people, and commerce through the lens of ethnobotany," according to SHP's website. As of this writing, ABC and SHP have held two webinars in this series. The first



webinar, “Plants, People, and Culture: The Science of Ethnobotany,” featured a discussion with ethnobotany experts, researchers, and authors Mike Balick, PhD, and Paul Cox, PhD, based on the recently released second edition of their book of the same name (CRC Press, 2020). In “Ethnobotany and the Secret Life of Plants,” Claudia Ford, PhD, an ethnobotanist, educator, and author, discussed medicinal plant use by African slaves in the American South during the 19th century.



Michael Balick, PhD, leads an ABC-SHP Ethnobotany webinar.

“Our new series of webinars is based on the basic nonprofit research and educational mission of ABC,” said ABC Founder and Executive Director Mark Blumenthal. “Our webinars provide additional value to ABC members, giving them more opportunities to learn directly from many key experts

in the various fields associated with herbalism. And, they are free!”

So far, the webinars have exceeded expectations in terms of viewership and, as with most of ABC’s content, these webinars are reaching a global audience. Balick and Cox’s ethnobotany webinar was particularly popular. More than 3,370 people in at least 38 countries had watched the live or recorded version of the webinar as of October 15, 2020.

“The Plants, People, and Culture webinar was truly the best I have watched in recent times,” noted one attendee, Nelle Rose, in feedback submitted to ABC (email, September 18, 2020). “Balick and Cox were full of joy and reverence. Together, they gave us a flowing narrative that was authentic in reflecting their basic theme of how stories matter.”

How to Watch

All webinars are free and available to the public. Participants must register for the event beforehand, and registration links are available on the webinar description pages, which can be found on ABC’s Webinars page and SHP’s Webinar Series page. Attendees can watch the webinars live on Zoom and Facebook Live, and participants are invited to submit questions in advance of and during the webinar. For those who are unable to attend the webinar, recorded versions are available for free on ABC’s Facebook page, SHP’s Vimeo channel, and through SHP’s and ABC’s websites.

ABC and SHP are currently planning additional webinars. For a full list of scheduled webinars, visit ABC’s Webinars page or SHP’s Webinar Series page. HG

Two additional ethnobotany webinars are currently scheduled: “From Peru to Pompeii: What Everyone Needs to Know About the Amazon with a Chaser of the Ethnobotany of Ancient Wine” with Mark Plotkin, PhD, of the Amazon Conservation Team (November 12, 2020); and “Cultural Values of Medicinal Plants” with Nancy Turner, PhD, an ethnobotanist and professor at Michigan State University (December 10, 2020). Wade Davis, PhD, explorer in residence at the National Geographic Society, and Steven King, PhD, executive vice president of sustainable supply, ethnobotanical research, and intellectual property at Jaguar Health, have also agreed to be featured speakers in future ethnobotany webinars, with topics and dates to be announced.

The Plants in Commerce webinars focus on individual herbs and include discussions with experts on quality and sustainability issues. The first Plants in Commerce webinar, held in early October, was on “Saw Palmetto: A Conversation on Sustainability, Quality, and Authentication” with herbal expert, author, and photographer Steven Foster; ABC Chief Science Officer Stefan Gafner, PhD; Umasudhan Pal, CEO and president of Valensa International; and Edward Fletcher, president of Native Botanicals. The next Plants in Commerce webinar will focus on elderberry (*Sambucus* spp., Adoxaceae).

According to ABC Founder and Executive Director Mark Blumenthal, the webinar series is an example of how ABC has been able to adapt during the pandemic to continue to serve its members and the public.

Join more than 200 responsible companies, laboratories, nonprofits, trade associations, media outlets, and others in the international herb and natural products/natural medicine community.

Become a valued underwriter of the ABC-AHP-NCNPR Botanical Adulterants Prevention Program, a multi-year, supply chain integrity program providing education about accidental and intentional adulteration of botanical materials and extracts on an international scale.

For more details on joining the program, and access to the free publications produced to date, please see www.botanicaladulterants.org or contact Denise Meikel at denise@herbalgram.org.



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Four Elements Organic Herbals Receives USDA Value-Added Producer Grant

By Hannah Bauman

In summer 2020, Jane Hawley Stevens, founder of Four Elements Organic Herbals, received a \$250,000 Value-Added Producer Grant from the US Department of Agriculture (USDA). The working capital grant, which Stevens applied for in late winter 2019, provides funding for agricultural producers to generate new products, create and expand marketing opportunities, and increase income.¹ Taking raw materials and turning them into a product, such as processing herbs into tea blends, or cultivating certified organic raw material are considered “value-added” according to the USDA.² To qualify for the Value-Added Producer Grant, the applicant must grow and process the material themselves.

Stevens founded Four Elements in 1987, and the 130-acre farm in North Freedom, Wisconsin, has been certified organic since 1990. Aided by her husband David Stevens, she processes the herbs from Four Elements into various products, including herbal tea blends, salves, tinctures, oils, and soaps.

Stevens has a degree in horticulture from the University of Wisconsin – Madison (UWM). David has a master’s degree in woody ornamental horticulture from UWM and is the curator of the Longenecker Horticultural Gardens at the UWM Arboretum. Despite growing and selling herbs, Stevens did not consider using them medicinally until her young son began having chronic earaches. When she tried applying an oil infused with mullein (*Verbascum thapsus*, Scrophulariaceae) flowers to his ears, the positive result surprised her so much that she started to use herbs herself and promote their medicinal value. Currently, the most abundant crop at Four Elements is lemon balm (*Melissa officinalis*, Lamiaceae), which the company has adopted through the American Botanical Council’s Adopt-an-Herb program.³

Though Stevens applied for the grant before the COVID-19 pandemic, the grant came at a crucial time for her busi-

FOUR ELEMENTS



ness. “I have never had a month like March 2020, and many herb growers probably had that same experience,” she said, referring to an initial sales boom for herbs indicated for immune support (oral communication, August 26, 2020). After the sales spike, however, she reported that her August sales were about half of what they were at the same time in 2019. “This grant is going to make all the difference.”

Stevens will use the grant mostly to increase market visibility for Four Elements. Before the pandemic, she hoped to make her products available on shelves at spas. However, with the temporary closures of many spas and similar businesses in the United States, she will focus on online marketing instead. Ultimately, she hopes that by expanding her online presence, she can reach more people who value organic and natural products.

“My ultimate goal is to get people to start looking at nature and engage more with nature,” Stevens said. “I think nature has the answer for so many things. I always want to keep the integrity of the plants in my products so that when people reach for Four Elements products, they can find something very close to the earth.”

An aerial view of the Four Elements organic farm. Photo courtesy of Jane Hawley Stevens



Stevens takes her stewardship of the earth seriously and is passionate about organic, sustainable agriculture. She credits careful cultivation with improved products. “Earth is a closed system, and whatever you put on the earth is going to come back to you,” she said. “That’s a big concern of mine. We should care about leaving this planet in better shape than when we came here.”

However, Stevens knows that her cultivation methods and smaller scale put her at a disadvantage against commercial-scale cultivators and manufacturers, which is why she applied for another grant. Four Elements received a USDA Value-Added Producer Grant in 2014 that allowed her to formulate and expand her line of herbal teas. “These federal funds are so important,” she said. “They assist small producers by helping them compete. This industry was started by people like me: farmers bringing products to co-ops. And then, when people started choosing organic and herbal wellness lifestyles, [large] corporations [got involved]. They have bigger marketing budgets, and people like me, the veterans of the industry, had a harder time making it in our own industry.”

Four Elements received another boost in 2020. In February, Jane and David Stevens received the Organic Farmers of the Year Award from the Midwest Organic and Sustainable Education Service (MOSES). According to Stevens, they are the first herb farmers to receive this award. “Because we’re in the Midwest, [previous winners] are community-supported agriculture businesses and corn [*Zea mays*, Poaceae] and soybean [*Glycine max*, Fabaceae] farmers. I thought it was important that a value-added herbal company was represented in that group, so I was really honored to be nominated for and then receive that award.” In her acceptance speech at the MOSES Organic Farming Conference, Stevens once again emphasized the importance of herbal medicine for not only the care of people, but for the planet.

“As a decades-long herbalist, organic farmer, and gardening-by-the-moon practitioner, I would say living in and with nature’s rhythm is a step toward a healthier, happier life,” said Stevens. “It supports us with knowing our right place, beginnings, endings, what to give or take, and the most essential aspects of life.

“The message I keep repeating is this: it’s so important to care about and know your growers,” she added. “The people who are out there planting the seeds and cultivating the medicinal plants — support them in the marketplace so that we continue to have herb growers out there. When I go to the organic farming conference, people are always asking if I could buy from them, too. Wouldn’t it be great if my business grew enough that I could help to support other regional organic farms? We would be creating and developing more organic farms ... [and] getting herbs into the hands of people who want them. However I can best serve that world, that’s important to me.” HG

References

1. Value Added Producer Grants. USDA Rural Development website. Available at: www.rd.usda.gov/programs-services/value-added-producer-grants. Accessed September 2, 2020.
2. Value-Added Marketing. USDA National Agricultural Library website. Available at: www.nal.usda.gov/afsic/value-added-marketing. Accessed September 11, 2020.
3. Four Elements Adopts Lemon Balm through ABC’s Adopt-an-Herb Program. [press release] Austin, TX: American Botanical Council; April 14, 2018. Available at: <http://cms.herbalgram.org/press/2018/FourElementsAdoptsLemonBalm.html>. Accessed September 3, 2020.

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Less Gas with Lemongrass?

Burger King aims to reduce methane with modified cattle diet

By Connor Yearsley

In July 2020, Burger King launched the Whopper® hamburger with Reduced Methane Emissions Beef, which is sourced from cattle that are fed lemongrass (*Cymbopogon citratus*, Poaceae). The company claims that supplementing the cattle's diet with lemongrass has the potential to reduce methane emissions from those animals by up to 33%.^{1,2}

The “reduced-methane” patty debuted at select Burger King locations in Austin, Los Angeles, Miami, New York, and Portland, Oregon. The company, which has more than 18,000 locations in more than 100 countries and US territories,³ also plans to expand the effort to Latin America and Europe.^{1,2} As part of its campaign, Burger King released a video ad featuring a country jingle and a yodeling, guitar-playing boy who emerges from a cow's “dairy air” singing, “When cows fart and burp and splatter, well, it ain't no laughing matter...”⁴

Burger King's initiative comes when some consumers are reducing meat consumption

for the environment's sake. Meat-sourcing companies like Burger King are under increased pressure to minimize their impacts on climate change. It is not clear how much Burger

King hopes to reduce its environmental footprint or how much the “reduced-methane” Whopper will cost the company. However, customers reportedly will not have to pay more for the burger. This is not Burger King's first effort to appear environmentally conscious: Under a partnership with Impossible Foods Inc., it also began selling the Impossible Whopper, a plant protein-based burger, in August 2019.²



Emission Control

According to the Food and Agriculture Organization of the United Nations (FAO), greenhouse gas emissions from agriculture, forestry, and fisheries have almost doubled over the past 50 years and could increase another 30% by 2050 without more efforts to reduce them.⁵

Livestock represent about 14.5% of all anthropogenic (i.e., from human activities) greenhouse gas emissions globally, and cattle represent about 65% of the livestock sector's emissions. About 44% of livestock emissions are in the form of methane, an odorless, colorless, flammable gas that is the major component of natural gas.⁶ On average, a single cow emits between 70 and 120 kilograms of methane per year, and the world contains about 1.5 billion cattle.⁷

Although methane is much less abundant than carbon dioxide, and its lifetime in the atmosphere is about 12 years, which is much shorter than that of carbon dioxide,⁸ methane has a global warming potential (GWP) about 86 times that of carbon dioxide over a 20-year period. That means methane will cause about 86 times as much warming as an equivalent mass of carbon dioxide over 20 years.⁹

Some experts believe that reducing methane emissions may be the most effective way to combat climate change right now, and according to the FAO, the greatest potential for reducing emissions in cattle includes better feed additives and/or supplements and feeding techniques.⁶

Cause for Controversy?

While the importance of reducing emissions is apparent, Burger King's latest effort has created some controversy. Some farmers called the video ad "condescending" and "hypocritical" and said they wished the company would find other ways to promote its initiative, while lifting the farmers up, not putting them down. Burger King said it intended to "shine a light on an issue that is important to the business and industry."¹⁰

Some scientists also criticized the video ad for focusing too much on flatulence and not enough on eructation (belching).¹⁰ After all, according to some data, about 95% of methane emissions from cattle are released through eructation, not flatulence.¹¹ While the video does mention "farts" more than "burps,"¹⁴ the word choices simply may be a product of what rhymes.

When the initiative launched, some scientists also refuted Burger King's claims about the methane-reducing benefits of lemongrass. At the time, those claims were based on preliminary, unpublished research.^{12,13} But that research,



Cow *Bos taurus*
Photo ©2020 Bramans

which was funded by its parent company, Restaurant Brands International, and conducted by researchers at Universidad Autónoma del Estado de Mexico, has since been published in the peer-reviewed journal *Animals*.¹⁴

In the study, four treatments were evaluated: a control diet, 100 g/day of lemongrass "dry matter" plus a control diet, 365 g/day of chamomile (*Matricaria chamomilla*, Asteraceae) dry matter plus a control diet, and 365 g/day of garden cosmos (*Cosmos bipinnatus*, Asteraceae) dry matter plus a control diet. Of those, lemongrass had the largest effect on methane yield, with a reduction of 33%, according to the study.¹⁴

The cattle in the study were fed the treatment for only the last three to four months of their lives, which was questioned by some scientists.^{12,13} During that time, the cattle are in the finishing phase of their lives, when they typically are confined to feedlots or barns before slaughter. Importantly, a different study found that more than 75% of methane emissions over the cattle's lifetime occurred before the finishing phase.¹⁵ A beef cow is typically between 18 and

Lemongrass *Cymbopogon citratus*
Photo ©2020 Steven Foster



24 months old at slaughter, so it emits methane while grazing in pastures for many months before the finishing phase. Therefore, it is important to evaluate ways to reduce methane emissions over the entire lifetime of the cattle, not just the last three to four months.¹²

“We did our study on the last three to four months of the life of the animals because that was the simplest way to validate the approach as proof of principle,” Burger King’s Chief Marketing Officer Fernando Machado was quoted as saying. “We always knew we had to expand the research to include different cattle, different feeds, longer term feed (beyond three to four months), among other variables.”¹³

Greener on the Other Side?

Burger King is continuing the studies with the researchers in Mexico and at the University of California, Davis (UC Davis).¹³ Initially, a study conducted by Ermias Kebreab, PhD, a professor in the Department of Animal Science at UC Davis, was not able to replicate the results of the study in Mexico. But Kebreab reportedly thinks that may be because the lemongrass used in his study was grown under different conditions and may have contained less tannins than the lemongrass used in the study in Mexico. He is planning a follow-up study that will use the same lemongrass.¹²

Kebreab was quoted as saying that “lemongrass contains essential oils and tannins, both of which have been shown to reduce methane emissions by modifying the [cattle’s] gut environment and inhibiting the microbes responsible for methane production.”¹⁶

Ruminants (cattle, sheep, goats, etc.) have a powerful digestive system that allows them to extract energy from fibrous plant materials better than other animals. That includes a stomach with four chambers, the largest of which is the rumen (hence, ruminant).¹² The rumen is where most methane emitted by ruminants is produced.¹⁷

In the rumen, a group of microorganisms called methanogens produce methane as a product of normal fermentation. They are reportedly the only known microorganisms that can produce methane. Up to 12% of cattle’s energy intake is lost through methane production.¹⁷ So, finding ways to favorably affect the microbiome in the rumen can mean that cattle potentially retain more energy while emitting less methane.¹²

Burger King’s effort will not “solve the climate change problem in the short term, but it is a scalable finding that may allow change in the future,” the company said in a statement. “The majority of conversation around this announcement has been overwhelmingly positive.”¹⁰

Other Feeds that May Bypass Gas

Researchers at the University of North Texas led by research professor Richard Dixon, PhD, have discovered ways to increase the production of tannins in alfalfa (*Medicago sativa*, Fabaceae) through genetic engineering. This may improve digestion in cattle and other ruminants. Though alfalfa is a good forage crop, the plant's protein is broken down rapidly during fermentation, which can cause potentially lethal bloating and release of methane.¹⁸

"As such, ranchers must spend time and effort moving animals from field to field to vary their diet," Dixon was quoted as saying. "But what if a rancher didn't have to do that?... By engineering alfalfa to produce tannin in its stems and leaves instead of just its seeds, the alfalfa's protein will be protected by the bound tannins, not breaking down so fast in the rumen and being better absorbed later in the digestion process."¹⁸

A 2016 study found that seaweeds may be used as nutritious animal feed with positive effects on methane yields. When incubated with meadow hay in an in vitro rumen, five seaweeds — *Ulva* sp. (Ulvaceae), *Laminaria ochroleuca* (Laminariaceae), *Saccharina latisima* (Laminariaceae), *Gigartina* sp. (Gigartinales), and *Gracilaria vermiculophylla* (Gracilariaceae) — led to methane reduction. But, of those, only *G. vermiculophylla* decreased methane when incubated with corn silage. This shows the importance of the animals' basal diet. The authors suggest that additional in vivo research should analyze the methane-reducing effects of seaweeds with different diets.¹⁹

In a 2020 study, Brahman-Angus steers were fed the red macroalgae *Asparagopsis taxiformis* (Bonnemaisoniaceae) at 0.05%, 0.1%, and 0.2% of feed organic matter for 90 days. Methane decreased up to 40% in steers that received 0.1% and up to 98% in steers that received 0.2% *A. taxiformis*. These steers also experienced significant weight gain improvements with no negative effects on daily feed intake or rumen function. The authors suggest that *A. taxiformis*, which contains multiple anti-methanogenic compounds, may have the potential to "revolutionize management" of methane emissions in the livestock sector.²⁰



Alfalfa *Medicago sativa*
Photo ©2020 H. Zell

A 2019 study evaluated the ability of Mootral (Mootral SA; Rolle, Switzerland), a patent-pending natural feed supplement that contains garlic (*Allium sativum*, Amaryllidaceae) powder and bitter orange (*Citrus aurantium*, Rutaceae) extracts, to reduce methane in cattle. Each day for 12 weeks, Jersey and Holstein-Friesian cows received 500 grams of pellets containing 3% Mootral powder. From baseline, methane decreased by 38.3% in Jersey cows and 20.7% in Holstein-Friesian cows with Mootral.²¹



Red algae *Asparagopsis taxiformis*
Photo ©2020 Jean-Pascal Quod

The company hopes to convince other companies, like McDonald's, to follow its lead. Significant potential exists to "drive wider industry improvement, so we are making our scientific research, learnings, and protocol formula publicly available in an open source manner to support this," Machado was quoted as saying.¹

In addition to lemongrass, other ingredients may also reduce methane yields in cattle (see sidebar). Meat producers could choose options that are most affordable for them, and if prices were imposed on emissions, then producers would be incentivized to adopt methane-reducing feed additives and/or supplements.¹²

It is important to realize, however, that methane-reducing feed addresses only part of the problem. For example, both synthetic fertilizers and decomposing manure left on pastures provide nitrogen to soil microbes, which turn that nitrogen into nitrous oxide,^{6,12} a potent greenhouse gas that causes significantly more warming than an equivalent mass of carbon dioxide.⁸ Processing and transportation of animal products also create emissions.⁶

Other improvements, therefore, also are needed, such as better manure management, breeding that would allow for smaller herds (fewer, more productive animals), and more regenerative agricultural practices.⁶ Still, Burger King's latest effort may be a step in the right direction. HG

References

1. Carman T. Burger King wants to combat climate change by helping its cows be a little less gassy. *The Washington Post*. July 14, 2020. Available at: www.washingtonpost.com/news/voraciously/wp/2020/07/14/burger-king-wants-to-combat-climate-change-by-helping-its-cows-be-a-little-less-gassy/. Accessed October 1, 2020.
2. Querolo N, De Sousa A. Burger King's Climate Solution Is a Limited-Supply Whopper. Bloomberg website. July 14, 2020. Available at: www.bloomberg.com/news/articles/2020-07-14/burger-king-s-climate-solution-is-a-limited-supply-whopper. Accessed October 1, 2020.
3. Restaurant Brands International Inc. 2019 Annual Report. Restaurant Brands International website. Available at: www.rbi.com/Cache/IRCache/b143171a-c8aa-eb27-d31b-91df7ec45aaa.PDF?O=PDF&T=&Y=&D=&FID=b143171a-c8aa-eb27-d31b-91df7ec45aaa&iid=4591210. Accessed October 1, 2020.
4. Burger King-Cows Menu Mexico. YouTube website. Available at: www.youtube.com/watch?v=RUOgBmqLd2I. Accessed October 1, 2020.
5. Agriculture's Greenhouse Gas Emissions on the Rise. Food and Agriculture Organization website. April 11, 2014. Available at: www.fao.org/news/story/en/item/216137/icode/. Accessed October 1, 2020.
6. Key Facts and Findings. Food and Agriculture Organization website. Available at: www.fao.org/news/story/en/item/197623/icode/. Accessed October 1, 2020.
7. Potential for Reduced Methane from Cows. Science Daily website. July 8, 2019. Available at: www.sciencedaily.com/releases/2019/07/190708112514.htm. Accessed October 1, 2020.
8. Overview of Greenhouse Gases. Environmental Protection Agency website. Available at: www.epa.gov/ghgemissions/overview-greenhouse-gases. Accessed October 2, 2020.
9. Vaidyanathan G. How Bad of a Greenhouse Gas is Methane? *Scientific American* website. December 22, 2015. Available at: www.scientificamerican.com/article/how-bad-of-a-greenhouse-gas-is-methane/. Accessed October 2, 2020.
10. US Farmers' Beef with Burger King over Cow Fart Ad. BBC website. July 16, 2020. Available at: www.bbc.com/news/business-53435857. Accessed October 2, 2020.
11. Hecht J. Well that Stinks! Reporters Blow Cow Farts Out of Proportion. *Scientific American* website. February 13, 2014. Available at: blogs.scientificamerican.com/dog-spies/well-that-stinks-reporters-blow-cow-farts-out-of-proportion/. Accessed October 2, 2020.
12. Chrobak U. The Inconvenient Truth about Burger King's "Reduced Methane" Whopper. Popular Science website. July 20, 2020. Available at: www.popsoci.com/story/environment/burger-king-reduced-methane-whopper-debunk/. Accessed October 2, 2020.
13. Sternlicht A. Burger King's Sustainable Whopper Only Reduces Methane Emission by 3% at Most, Scientists Say. *Forbes*. July 20, 2020. Available at: www.forbes.com/sites/alexandrasternlicht/2020/07/20/burger-kings-sustainable-whopper-only-reduces-methane-emission-by-3-at-most-scientists-say/#71bafef07d7d. Accessed October 2, 2020.
14. Vázquez-Carrillo MF, Montelongo-Pérez HD, González-Ronquillo M, Castillo-Gallegos E, Castelan-Ortega OA. Effects of three herbs on methane emissions from beef cattle. *Animals*. 2020;10(9):1671. doi:10.3390/ani10091671.
15. Rotz CA, Asem-Hiablie S, Place S, Thoma G. Environmental footprints of beef cattle production in the United States. *Agric Sys*. 2019;169:1-13.
16. Mock S. Less Windy Whoppers? Low-Methane Burger King Still Involves Some Hot Air. *The Guardian*. July 22, 2020. Available at: www.theguardian.com/environment/2020/jul/22/less-windy-whoppers-low-methane-burger-king-still-involves-some-hot-air. Accessed October 2, 2020.
17. Hook SE, Wright ADG, McBride BW. Methanogens: Methane producers of the rumen and mitigation strategies. *Archaea*. 2010;2010:945785. doi:10.1155/2010/945785.
18. UNT BioDiscovery Institute Team Develops Ways to Improve the Environmental Footprint of Alfalfa for Livestock [press release]. Denton, TX: University of North Texas; November 27, 2018. Available at: news.unt.edu/news-releases/unt-biodiscovery-institute-team-develops-ways-improve-environmental-footprint-alfalfa. Accessed October 5, 2020.
19. Maia MRG, Fonseca AJM, Oliveira HM, Mendonça C, Cabrita ARJ. The potential role of seaweeds in the natural manipulation of rumen fermentation and methane production. *Sci Rep*. 2016;6:32321. doi: 10.1038/srep32321.
20. Kinley RD, Martinez-Fernandez G, Matthews MK, de Nys R, Magnusson M, Tomkins NW. Mitigating the carbon footprint and improving productivity of ruminant livestock agriculture using a red seaweed. *J Clean Prod*. 2020;259:120836.
21. Vrancken H, Suenkel M, Hargreaves PR, Chew L, Towers E. Reduction of enteric methane emission in a commercial dairy farm by a novel feed supplement. *Open J Anim Sci*. 2019;9:286-296. doi: 10.4236/ojas.2019.93024.

Kiss the Ground Documentary Explores Promise of Regenerative Agriculture

By Ann Armbrecht, PhD

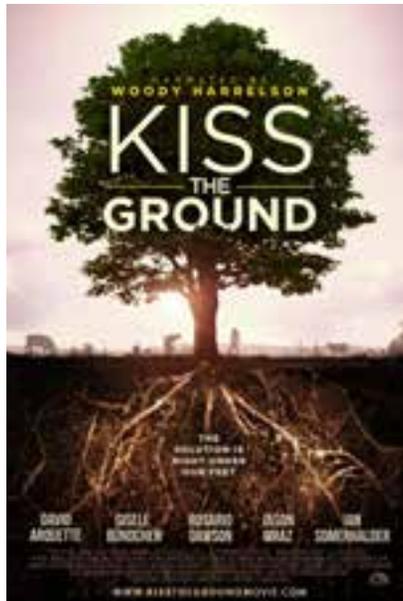
***Kiss the Ground*, an 84-minute documentary directed by Josh Tickell and Rebecca Tickell and narrated by Woody Harrelson, takes a detailed look at regenerative agriculture, a type of farming that has the potential to balance climate, replenish water supplies, and feed the world.**

Based on the book *Kiss the Ground: How the Food You Eat Can Reverse Climate Change, Heal Your Body & Ultimately Save Our World* (Enliven Books/Atria, 2017) by Josh Tickell, the film balances sobering facts with inspiring accounts of individuals working to make a difference. The pacing is excellent, the footage engaging, and the overall message is powerful and clear.

Like many of this genre, the film moves from an account of how dire things are toward potential solutions. Innovative graphics make complex soil science clear and accessible and demonstrate how conventional farming practices deplete rather than replenish soil health, which leads to desertification and contributes to climate change. Five percent or fewer of farms practice regenerative soil management, according to the film, and many farmers do not know how soil works. With the decoupling of livestock and row crops from commercial agriculture, there is no ongoing soil fortification, hence the need for added inputs, especially nitrogen, to maintain soil health. The application of synthetic chemical fertilizers then masks underlying problems with the soil. Two hundred peer-reviewed studies reportedly connect these chemicals with attention-deficit/hyperactivity disorder (ADHD), various cancers, and more.

Speaker after speaker, such as soil microbiologist Kristine Nichols, PhD, environmentalist Paul Hawken, activist Pashon Murray, and current governor of California Gavin Newsom, makes the point that these chemicals kill microbes in the soil, turning it into dirt. Unless we change our farming practices, we have a projected 60 annual harvests left. The ways we are feeding ourselves, in other words, is undermining our survival. Poor land leads to poor people, and poor people lead to social breakdown. These are all connected, and change, the film suggests, begins with feeding the soil to nurture living systems.

A soil-covered planet is a healthy planet, a point made graphically clear with side-by-side images of fields where the soil is cared for and those where it is not. Equally powerful are before-and-after images taken in communities that committed to reversing the desertification of the soil.



Cover artwork for *Kiss the Ground*

Changing the microclimate can change the macroclimate by both rebuilding the health of the soil and helping sequester carbon. But it must be done to scale, which the film suggests is a collective effort.

Every purchase people make is a choice: Are we regenerating the soil or are we degenerating it?

Though the film does not discuss herbal products specifically, this question is just as relevant and important for the botanical industry and consumers. Are these herbs, which are grown to be used in health and wellness products, sourced from farms that managed the health of the soil?

In other words, what is the true cost of the herbal products we purchase for our personal health? Are our purchases building soil health, community health, and, ultimately, ecosystem health?

This film shows the power of individuals' choosing to take action. To address the scale of the problem, all of us need to get involved, and *Kiss the Ground's* accompanying website offers a diverse "Take Action" section, including a Farmland Program that offers training and educational resources and technical support to help farmers and ranchers transition to regenerative agriculture. The website also includes a free downloadable middle school curriculum on the subject of healthy soil; a guide for purchasing produce, meat, dairy, soils, flowers, cosmetics, coffee, clothing, and other items that are good for the environment and explaining why these choices matter; questions to ask farmers; and other ways to make a difference.

I watched the film with my 16-year-old son, who has grown up with information about climate change and other dire news. Even so, *Kiss the Ground* — the animation, the facts shared (not just opinions, he said), the famous people (including singer-songwriter Jason Mraz and actors Rosario Dawson and Ian Somerhalder), the examples of what we can do to make a difference, even if we do not own a farm — all held his attention. He thought he knew a lot about the climate but, he said, he had not realized how important the soil is and what is at stake if we don't keep it healthy.

More information on the documentary, including screenings, the trailer, and further reading, can be found at kissthegroundmovie.com. The film premiered on Netflix on September 22, 2020. HG

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The Murder of Maya Healer Domingo Choc Che

A Q&A with Mónica Berger Gonzalez and Michael Heinrich

By Connor Yearsley

In early June 2020, Domingo Choc Che, 55, a Q'eqchi' Maya spiritual guide and traditional medicine expert, was brutally tortured and murdered after a group of people seized him from his home in Chimay, Guatemala.¹

The abductors allegedly accused Choc Che of witchcraft and performing a ceremony on a grave, beat him for more than 10 hours, doused him with gasoline, and set him on fire. A video shows Choc Che on fire, running, and asking for help before collapsing. Police arrested two men and two women in connection with his murder.¹ One man was released because of lack of proof. The trial for the others was originally scheduled to begin on October 15, 2020, but was rescheduled for October 28 when the defense lawyer did not appear. At press time for this article, the status of the trial was unknown.

Choc Che, who was affectionately called “Tata (‘Grandfather’ or ‘Elder’) Domingo,” participated in several research projects to conserve traditional Maya knowledge. At the time of his death, he was one of 30 participants in a project to document traditional medicinal plants in the Petén department of Guatemala. Launched in May 2019,

this ongoing initiative is a collaboration among University College London (UCL), Zurich University, and Universidad del Valle de Guatemala (UVG).¹

In *The Guardian*, Michael Heinrich, PhD, UCL professor of ethnopharmacology and pharmacognosy, was quoted as saying that Choc Che’s murder “is an atrocity, a huge violation of the most basic human rights, and leaves one with a feeling of helplessness.”¹

For some people, his death is a harsh reminder of Guatemala’s 36-year genocidal civil war, which lasted from 1960 to 1996. During that time, more than 200,000 people reportedly were killed and an additional 45,000 disappeared. Eighty percent of victims during the war were indigenous. The 1996 Guatemalan peace accords recognized the rights of indigenous peoples to their traditions, but prejudices and persecution continue.¹

Below is a Q&A with Mónica Berger Gonzalez (MBG), PhD, director of the Unit of Medical Anthropology at UVG, and Heinrich (MH), both of whom worked with Choc Che. The responses have been edited and are based on email communications with Gonzalez and Heinrich on August 27 and 28, 2020, respectively.



Domingo Choc Che
Courtesy of Mónica Berger Gonzalez

Can you describe Domingo Choc Che as a person? What was he like?

MBG: Domingo was a kind and quiet man. He kept to himself and was most comfortable walking in the forest to collect plants. He was wise and full of love for nature, animals, and people. He took his job as an *ajilonel* (a Maya traditional herbalist-healer) seriously, though he never promoted himself as a healer. He used to say that healing and plant knowledge were gifts given by the Creator, and one should be humble about them. He treated everyone who came to see him. He was humble. In meetings, he waited for everyone to talk and only at the end asked questions, which were often profound. Over the years, he took care of many people with afflictions and worked as a support counselor for victims of the armed conflict who needed emotional and spiritual support.

Can you describe Choc Che’s contributions to the project, especially those related to medicinal plants?

MBG: Along with 15 other Q'eqchi' herbalists, Domingo’s role involved thoroughly documenting his daily healing practice, including details about the types of patients he treated, diagnoses, and associated treatments. After six months of this documentation, he [went] with our team of biologists into the forest to collect the medicinal plants

that were listed in his treatments. He was trained on modern methods of ethnobotanical collection and herborization [the collection and study of plants] and helped gather all the samples to be sent to UVG's herbarium for identification. He was a lover of the forest and shared his knowledge openly with our anthropology and biology students. He shared not only medical information but many details about the plants' growth, energy, and spiritual uses in Maya practice. He was open to questions and often shared his plans for creating a medicinal plant garden to help rescue species at risk of disappearing due to habitat destruction, etc. He was part of an effort to build a *popol jay*, the "House of the Council," a place with a medicinal plant garden where new generations of ajilonel could be trained.

How difficult and important is it to continue the project after what happened to him?

MBG: The Maya elders continue to be persecuted and confused as "evil witches," due to widespread lack of knowledge about Maya medicine and spirituality. To address the fear caused by ignorance, we more than ever need to continue efforts to communicate to society in general that the knowledge of an ajilonel is actually Maya science. In Maya cosmogony, ignorance is the first "sin" of the *Wuqub' Qaqix* (the seven veils that keep us from being at peace with the Creator, according to Maya spirituality). It was ignorance, lack of knowledge, and fear of what we do not understand that led people to burn Tata Domingo. Therefore, it is important to bring to light the depths of this ancient medical system with respect, while honoring and crediting the elders. Research is imperative, and communication of the results with respect for intellectual property has to be our goal.

MH: We need much more national and international recognition of the tremendous contributions of traditional knowledge holders and other people in local communities. Therefore, it is crucial to continue the project, and we will.

What should people know about this crime? What should they learn from it?

MBG: People need to know that ignorance is not harmless, prejudices kill, and fanaticism without compassion is dangerous. Religious freedom is not a given, racism shows in many forms, and it takes everyone to end cycles of hatred, mistrust, and ignorance. A society where this type of crime can happen has to heal and learn, and this is a collective effort. This is not only the fault of those who committed this crime. It is a mirror of our society's blindness to the value of other epistemic systems and sources of knowledge. We are still suffering from minds embedded in colonialism.

MH: This was in no way the first, nor will it be the last, murder of this type. There remains a level of marginal-

ization and exploitation that needs to be overcome, and not only in Guatemala. A few weeks later, in late June, a group of Ikoots (Huave) men and women were murdered in Oaxaca, Mexico, due to territorial conflicts.²

What needs to change to prevent a crime like this from happening again?

MBG: We need to conduct systematic research in transdisciplinary formats in which Maya ajilonel are co-researchers. We need peer-reviewed papers, but we also need information published in Spanish and in many formats for a wide audience. People need to know who Domingo was and that with his death a library was burned to the ground.

MH: Change is complex, and there is no short-term solution. I hope that projects like ours will help in the long run. We need to ensure that rights are defended. This point has been made by many activists, scientists, and others. The global understanding of the current situation and challenges in rural regions, especially for indigenous people but also for national and international migrants, is very limited and often does not reflect the social and cultural realities. We also need support to develop livelihoods for people in these regions. These regions are no longer pristine forests, and we must empower communities to develop local, sustainable economies that respect traditions and biodiversity.

Why do you think this happened?

MBG: This is multicausal. It is an impoverished area with few services, an absent state, not enough food, jobs, and education, and too much intolerance.

MH: The project was not the trigger, but Don Domingo's knowledge and ability to heal were causes of fear, hate, and disdain. It is crucial to ensure dignity, tolerance, and mutual respect of diversity. HG

References

1. Abbott J. Outrage as Guatemalan Maya spiritual guide is tortured and burned alive. *The Guardian* website. June 10, 2020. Available at: www.theguardian.com/world/2020/jun/10/guatemalan-maya-spiritual-guide-tortured-burned-alive. Accessed September 4, 2020.
2. Serious acts of violence against community in San Mateo del Mar, Oaxaca. PBI Mexico website. Available at: pbi-mexico.org/news/2020-07/serious-acts-violence-against-community-san-mateo-del-mar-oaxaca. Accessed September 4, 2020.

Eshnan Supplementation Reduces Incidence and Alleviates Symptoms of Recurrent Cystitis in Women

Reviewed: Kamalifard M, Abbasalizadeh S, Mirghafourvand M, et al. The effect of *Seidlitzia rosmarinus* (*eshnan*) on the prevention of recurrent cystitis in women of reproductive age: A randomized, controlled, clinical trial. *Phytother Res*. February 2020;34(2):418-427. doi: 10.1002/ptr.6534.

By Shari Henson

Cystitis is a symptomatic acute or chronic bladder infection often caused by *Escherichia coli* bacteria. Recurrent cystitis is the occurrence of the infection twice or more in six months or three or more times in 12 months. Some herbal medicines are used to treat and control recurrent cystitis. Eshnan (*Seidlitzia rosmarinus*, Amaranthaceae) is reported to have antibacterial, anti-inflammatory, antiseptic, anti-urinary retention, and diuretic effects. The authors conducted a randomized, triple-blind, controlled trial to determine the efficacy of eshnan for preventing the incidence of recurrent cystitis.

The study included 126 women who had been diagnosed with recurrent cystitis at any of the health centers in Parsabad, Iran, between October 2017 and November 2018. They had not taken antibiotics during the month before the study and were not taking immune system-suppressing medications. All patients had to have clinical symptoms of a urinary tract infection (UTI) and negative urine cultures (absence of bacterial infection) to be included in the study. Those with positive urine cultures were treated for cystitis with antibiotics, tested again a week after finishing the medication, and enrolled in the study if the test was negative. The patients were randomly assigned to the eshnan and placebo

Study Details: At a Glance	
Study Design	Randomized, triple-blind, controlled trial
Participants	126 women diagnosed with recurrent cystitis
Intervention	Ground, encapsulated eshnan powder (plant part not specified)
Control	Starch placebo
Disclosures	None declared

groups, with 63 in each group. Mean ages were 36.1 years in the eshnan group and 36.7 years in the placebo group.

Eshnan purchased from an herbal store was dried and ground. The authors analyzed the chemical composition of the ground herb, but they did not describe the authentication of the material in the paper. Capsules were filled with 500 mg of either the ground eshnan powder or starch as the placebo. The patients were instructed to take three capsules 30 minutes after each meal daily for two months. They were followed for four months after completing the study medications. During weekly phone calls, the patients were asked about medication intake, adverse effects, and cystitis symptoms.

Eshnan *Seidlitzia rosmarinus*
Photo ©2020 Alex Sergeev



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After two, four, and six months, patients were assessed for clinical symptoms of recurrent cystitis, and urine samples were collected and tested. Any patients with clinical symptoms of cystitis at any time during the study underwent evaluations; those with positive cultures received the appropriate antibiotics “so as to continue the intervention,” the authors explained. Patients with symptoms and positive cultures twice or more during the study were given a “definitive diagnosis” of recurrent cystitis, referred to a physician for treatment, and followed up with until the end of the study. Five patients in the eshnan group and four patients in the placebo group did not attend the follow-up visits and were not included in the final analyses.

Sociodemographic and personal health data were similar between the two groups. Cystitis was diagnosed in 11 (19%) patients from the eshnan group and 32 (55.2%) from the placebo group by the second month; in 13 (22.4%) patients from the eshnan group and 33 (56.9%) from the placebo group by the fourth month; and in 19 (32.8%) patients from the eshnan group and 43 (72.9%) from the placebo group by the sixth month ($P < 0.001$ for all time points). Eight (13.8%) patients in the eshnan group and 39 (66.1%) in the placebo group were diagnosed with recurrent cystitis ($P < 0.001$) during the study.

After two months of intervention, the eshnan group experienced a significantly lower incidence of frequent urination ($P = 0.002$) and dysuria (painful urination; $P < 0.001$) compared with the placebo group. After four months, frequent urination ($P = 0.001$) and suprapubic pain ($P = 0.027$) were significantly reduced in the eshnan group compared with the placebo group. After six months, compared with the placebo group, the eshnan group had significantly lower incidences of frequent urination ($P < 0.001$), dysuria ($P = 0.020$), and oliguria (the production of abnormally small amounts of urine; $P = 0.005$). No adverse effects were reported in either group.

Because this study was conducted in healthy, nonpregnant, and nonlactating women of reproductive age, the results cannot be generalized to women of other age groups or to pregnant and lactating women. Also, because the participants' medication intake, side effects, and cystitis symptoms were assessed during phone calls with the researchers, the results may have been influenced by self-reporting biases.

The authors concluded that eshnan significantly reduced the incidence of recurrent cystitis and alleviated the symptoms. “Given the benefits of this plant in terms of preventing the incidence of cystitis without causing any side effect[s], the harmful effects of chemical medications, and the growing use of herbal medicines, this plant can be used to prevent the incidence of recurrent cystitis and reduce its complications and also to reduce the prevalence of multi-drug resistance in UTI treatment,” they wrote. HG

Psychiatric Patients Treated with Herbal Combination Product Require Fewer Prescriptions for Benzodiazepines

Reviewed: Keck ME, Nicolussi S, Spura K, Blohm C, Zahner C, Drewe J. Effect of the fixed combination of valerian, lemon balm, passionflower, and butterbur extracts (Ze 185) on the prescription pattern of benzodiazepines in hospitalized psychiatric patients — A retrospective case-control investigation. *Phytother Res.* June 2020;34(6):1436–1445. doi: 10.1002/ptr.6618.

By Shari Henson

Stress can cause various psychiatric and somatoform (unexplained) symptoms, including sleep disturbances. Benzodiazepines are used to improve sleep; however, their long-term use can cause adverse effects. Herbal products may help improve stress-related disorders. Ze 185 (Relaxane®; Max Zeller Söhne AG; Romanshorn, Switzerland) is a combination of valerian (*Valeriana officinalis*, Caprifoliaceae) root, lemon balm (*Melissa officinalis*, Lamiaceae) leaf, passionflower (*Passiflora incarnata*, Passifloraceae) herb, and butterbur (*Petasites hybridus*, Asteraceae) root extracts and has been studied for its effects on somatoform disorders and anxiety. These authors conducted a single-center, retrospective, case-control study to investigate the effects of Ze 185 on the prescription pattern of benzodiazepines and other concomitantly prescribed drugs in hospitalized patients with psychiatric and somatoform disorders.

Study Details: At a Glance	
Study Design	Retrospective, case-control study
Included Patients	1,548 patients who received Ze 185 and 1,704 matched control patients
Intervention	Herbal combination product Ze 185 (Relaxane®; Max Zeller Söhne AG; Romanshorn, Switzerland)
Control	Patients matched by age, gender, length of hospitalization, and classification of disorder
Disclosures	Two authors (Keck and Spura) were employees of the Clenia Private Clinic Schlössli. The other authors are or were employees of Max Zeller Söhne AG.

Passionflower *Passiflora incarnata*
Photo ©2020 Steven Foster



The authors analyzed the electronic medical records of patients older than 18 years who were hospitalized between January 2010 and May 2013 at the Clenia Private Clinic Schlössli in Zurich, Switzerland, which provides treatments for psychiatric, psychotherapeutic, and psychosomatic disorders. All patients who were treated with any dose of Ze 185 on at least one day during their clinic stay were considered cases for the study. The control population consisted of patients not treated with Ze 185 who were matched with the case patients by age, gender, length of hospitalization, and main International Classification of Diseases, Version 10 (ICD-10) F-diagnosis, indicating a mental, behavioral, or neurodevelopmental disorder. For the data analysis, the authors identified 3,252 patients, of which there were 1,548 cases who received Ze 185 treatment and 1,704 matched controls.

Each Ze 185 tablet contains 90 mg of a 90% per weight ethanolic extract of butterbur root, 90 mg of a 45% per weight methanolic extract of valerian root, 90 mg of a 50%

per weight ethanolic extract of passionflower herb, and 60 mg of a 20% per weight ethanolic extract of lemon balm leaves.

The most frequent primary ICD-10 diagnosis was F3 (mood [affective] disorders), and the second-most frequent primary diagnosis was F1 (mental and behavioral disorders due to psychoactive substance use). Those diagnoses were similar between the groups. Significant between-group differences were observed for the primary diagnoses F2 (schizophrenia, schizotypal, and delusion disorders), with 101 cases and 181 controls ($P < 0.001$), and F4 (neurotic, stress-related, and somatoform disorders), with 185 cases and 163 controls ($P = 0.028$).

The effectiveness of the hospital stay was assessed using three measures of disease and symptom severity: the Clinical Global Impression (CGI) score, the Global Assessment of Functioning (GAF) score, and selected items on the Association for Methodology and Documentation in Psychiatry (AMDP) system. A significant treatment effect

Valerian *Valeriana officinalis*
Photo ©2020 Steven Foster





Butterbur *Petasites hybridus*
Photo ©2020 Steven Foster

was seen in both groups for CGI and GAF scores at the end of the hospital stay ($P < 0.001$ for both). Significantly lower scores (meaning more severe symptoms) were seen for the GAF in the control group compared with the patients who took Ze 185 ($P = 0.034$). In both groups, each item on the AMDP system improved significantly from baseline to the end of treatment ($P < 0.001$).

The number of Ze 185 patients who received prescriptions for benzodiazepines as a treatment for anxiety was significantly lower than the number of patients in the control group ($P = 0.006$). However, more Ze 185 cases than controls were prescribed hypnotics, sedatives, and antidepressants ($P < 0.001$). Among those who also received hypnotics and sedatives, the valerian/hops (*Humulus lupulus*, Cannabaceae) extract Ze 91019 (Alluna®; Max Zeller Söhne AG) was prescribed more often for Ze 185 patients than for controls ($P < 0.001$).

Limitations of this study include: the different treatment durations and multiple concomitant drugs used by some of the patients; the inclusion of patient data from only one clinic; slightly different characteristics of the cases and controls at baseline; the lack of detailed adverse effect monitoring; and the possible confounding bias due to the patients' and/or physicians' preferences for the use of benzodiazepines or herbal drugs that could have influenced the prescription patterns.

The authors conclude that “both treatment modalities had a comparable clinical effectiveness but with significantly [fewer] prescriptions of benzodiazepines in the Ze 185 group.” However, because of the increased use of sedatives and hypnotics in the Ze 185 group, these effects should be further investigated in randomized, controlled clinical trials. HG



Lemon balm *Melissa officinalis*
Photo ©2020 Steven Foster

Systematic Review Shows Ginkgo Extract Improves Neurological Function in Patients Recovering from Ischemic Stroke

Reviewed: Ji H, Zhou X, Wei W, Wu W, Yao S. *Ginkgol* [sic] *biloba* extract as an adjunctive treatment for ischemic stroke: A systematic review and meta-analysis of randomized clinical trials. *Medicine (Baltimore)*. January 2020;99(2):e18568. doi: 10.1097/MD.00000000000018568.

By Shari Henson

According to the World Health Organization, roughly 15 million people per year have a stroke. In 2017, strokes were the leading cause of death in China. More than two-thirds of strokes in Asians are ischemic, which result from a blockage in the blood supply to the brain. Current treatments for ischemic stroke are not readily available and are only moderately effective. In China, ginkgo (*Ginkgo biloba*, Ginkgoaceae) extract (GBE) often is used as an adjunctive treatment for ischemic stroke. These authors conducted a systematic review and meta-analysis of randomized, controlled trials and critical appraisals on the effectiveness and safety of GBE when used for the different phases of ischemic stroke. Recovery from ischemic stroke comprises an acute phase (less than two weeks after symptom onset), a stationary phase (two weeks to six months after symptom onset), and a sequelae, or convalescence, phase (six months or longer after symptom onset).

The authors searched four English and three Chinese databases from the date of inception until September 2018. They included trials of any language or publication type that evaluated the efficacy and safety of GBE in any age, race, gender, or disease phase. Oral GBE treatments in the studies had to be taken for two weeks or longer. Studies that used control groups or conventional medicine groups were included; those that used traditional Chinese medicine or Chinese patent medicines as controls were excluded. The authors looked for study outcomes that included all-cause mortality, adverse events, changes in neurological function, recurrence rates, dependence (ability to carry out basic daily activities), vascular events, and quality of life.

The authors identified 15 trials published between 2010 and 2018 that included patients (N = 1,829) who were randomly assigned to GBE treatments or control/conventional treatments. Sample sizes ranged from 62 to 348 patients per trial. Ten trials enrolled 946 patients in the acute phase of stroke, four trials enrolled 535 patients in the convalescence phase, and one trial enrolled 348 patients in various phases. Most studies compared GBE plus conventional therapy with conventional therapy only, or GBE plus conventional therapy with placebo plus conventional therapy. Among the conventional treatments used were antiplatelet or anticoagulant therapies, neuroprotective agents, nutritional support, and control of serum glucose or blood pressure.

Study Details: At a Glance	
Study Design	Systematic review and meta-analysis of randomized, controlled trials and critical appraisals
Included Studies	15 randomized, controlled trials
Participants	1,829 men and women total
Disclosures	None declared

Only one trial was double-blinded, and one trial was single-blinded. In the other 13 trials, GBE was used only in the experimental groups, making it impossible to blind the participants and personnel. Quality of the trials was rated as moderate for evidence of vascular events and recurrence rates and low for evidence of mortality.

Acute Phase of Ischemic Stroke*

None of the trials with patients in the acute phase of ischemic stroke reported all-cause mortality or serious adverse events. In two trials (n = 425) that reported dependence, significant improvements were observed with the use of GBE plus conventional therapy compared with placebo plus conventional therapy ($P < 0.001$).

Seven trials measured neurological function or clinical effect outcomes. The results showed that GBE plus conventional treatment was more effective than conventional treatment alone in improving neurological function after 14 days of treatment ($P < 0.001$). In three trials, for which the outcomes were measured by using the National Institutes of Health Stroke Scale (NIHSS), adding GBE to conventional treatment significantly improved NIHSS scores compared with conventional treatment alone or conventional treatment plus placebo ($P < 0.001$).

None of the acute-phase trials reported recurrence rates. One trial with 106 participants reported dizziness and nausea in one patient each in the GBE group and dizziness in one control patient. In another trial of 88 participants, two participants in the GBE group reported facial flushing. All adverse events disappeared after symptomatic treatment.

Convalescence Phase of Ischemic Stroke

Heterogeneity was minimal in the two trials that reported vascular events in patients during the convalescence phase

* One peer reviewer of this summary noted a discrepancy in the journal article. He wrote: "In the text, the authors say that adding GBE to conventional treatment in the acute stage improved Barthel Index and Neurological Function Deficit Score. However, the Forest plots in Figures 3 and 4 appear to indicate the opposite, the analysis seems to favor control treatment."

Ginkgo *Ginkgo biloba*
Photo ©2020 Steven Foster



of ischemic stroke. A meta-analysis of the trials revealed no significant differences in vascular events in the GBE-plus-conventional-treatment group compared with the conventional-treatment-only group.

Two trials assessed dependence in 407 participants. The improvements with GBE plus conventional therapy were greater than with conventional therapy alone or conventional therapy plus placebo ($P < 0.001$). Two convalescence-phase trials reported recurrence rates. In one of those trials ($n = 57$), which compared GBE alone with placebo alone, only one patient in the placebo group experienced a recurrent stroke during a four-month follow-up. In the other trial, which was a two-year multicenter trial ($n = 348$), which compared GBE plus conventional therapy (treatment group) with conventional therapy alone (control group), nine patients in the treatment group and 14 patients in the control group reported recurrent stroke (a nonsignificant between-group difference).

In one trial that assessed mortality, four patients in the GBE group and one patient in the control group died during treatment or during a two-year follow-up period.

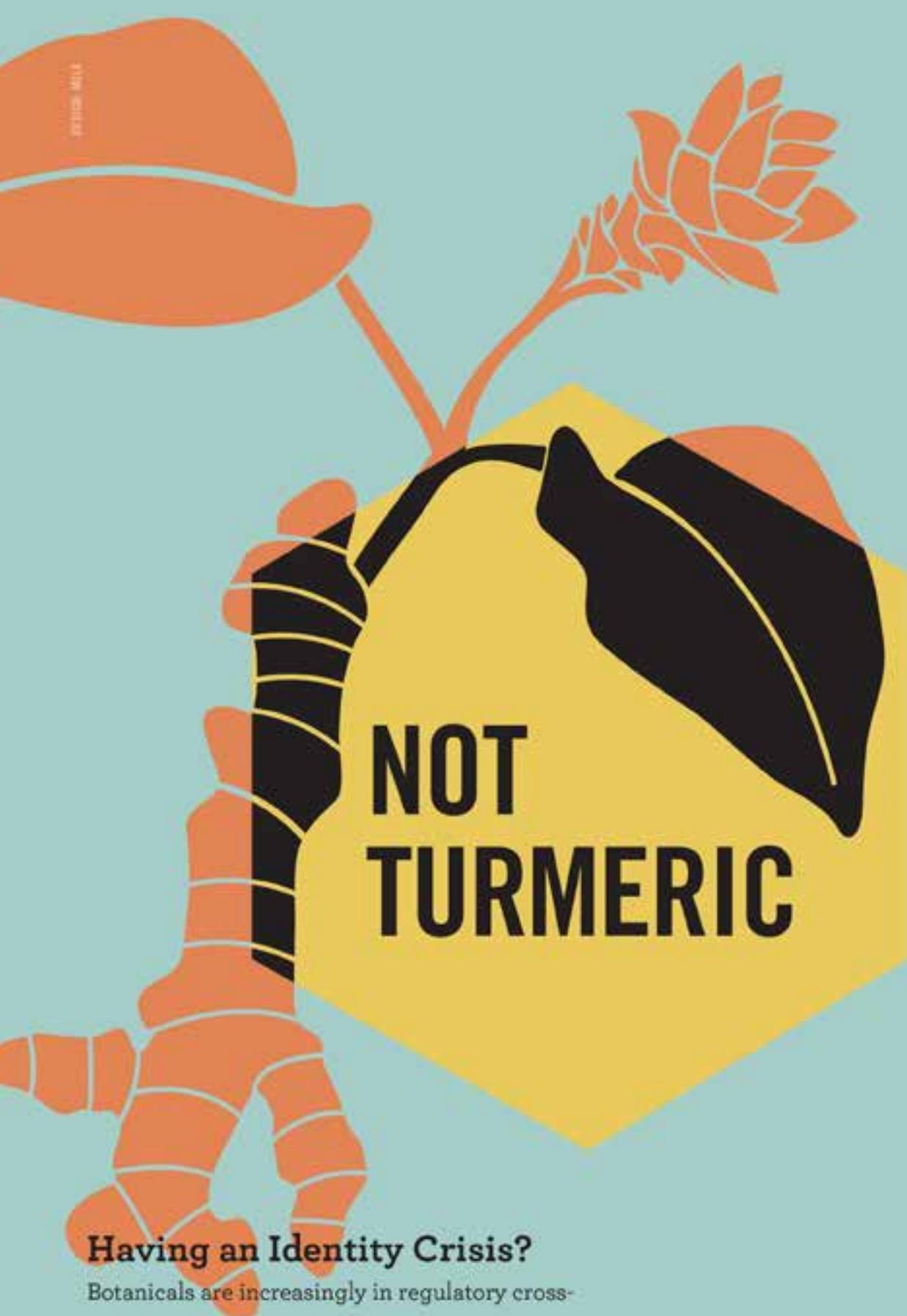
In another trial, seven patients in the GBE group and nine patients in the control group died during the study; between-group differences were not significant. In four trials with 613 patients, greater improvements in neurological function were observed in patients who used GBE as an add-on to conventional therapy compared with conventional therapy alone ($P < 0.001$).

One six-month trial with 346 participants reported these “nonserious” adverse events: vomiting, change in blood sugar levels, myocardial infarction, nephritis, sick sinus syndrome, and pneumonia. All events, except for vomiting, were considered to be unrelated to the study treatment.

This review is limited by the small number of studies and their low quality. The authors concluded that GBE with conventional therapy reportedly improves neurological function and dependence compared with conventional therapy alone for patients who have had an ischemic stroke. No beneficial effects of GBE on recurrence rates were found. HG

Ginkgo Ginkgo biloba
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Prickly Pear Predicament Cactus Moth Arrives in Texas

By Connor Yearsley

Native to South America, the cactus moth (*Cactoblastis cactorum*), which has been described as “voracious,” has arrived and is spreading in Texas. The moth threatens to devastate prickly pear (*Opuntia* spp., Cactaceae), which is the state cactus of Texas, and possibly other cactus species in the Opuntioideae subfamily and may have consequences for entire desert ecosystems. These cacti are ecological keystone species and an important source of income for people, especially in Mexico. The possibility that the moth may spread into Mexico and further west in the United States is a serious concern.¹⁻³

Researchers at the University of Texas at Austin (UT) are planning to introduce a parasitoid wasp species to control the moth (see “Wasp Versus Moth” section), but they have been hindered by the COVID-19 pandemic, so the moth may continue to spread unchecked, at least until the researchers’ work can resume.

In December 2019, at least a year after initial reports of the moth’s arrival in Texas, UT integrative biology professor Larry Gilbert, PhD, and graduate student Colin Morrison

found the moth among prickly pear cacti at the Mad Island Wildlife Management Area on the Gulf Coast of Texas. And, in February 2020, the moth was seen in Columbus, Texas, about 90 miles southeast of Austin. Five infected cactus pads (cladodes) that Gilbert brought to UT’s Brackenridge Field Laboratory reportedly produced almost 200 moth larvae.¹

The cactus moth’s larvae eat the cladodes from the inside out and can destroy entire stands of cacti, causing them

Prickly pear *Opuntia* sp.
Photo ©2020 Pi Lens



Cactus moth *Cactoblastis cactorum*
Photo ©2020 Larry Gilbert

to collapse in rotting heaps (see “Controlling *Cactoblastis cactorum*” section). In some places where prickly pear is considered an invasive pest, the moth has been used to control the cacti. The moth was introduced intentionally to Australia in 1925 to control a dense infestation of non-native prickly pear there and reportedly cleared 25 million hectares (61.8 million acres) of *O. stricta*, demonstrating its destructive potential. Later, the moth was introduced to other places with prickly pear problems, including the Caribbean in 1957.¹⁻⁴

“If prickly pear is native, you would not want this moth,” said Rob Plowes, PhD, UT research scientist who is working with Gilbert (oral communication, June 9, 2020). “But, if prickly pear is a pest, maybe you would want to bring in the moth. In many places in Africa, prickly pear has become established and is a huge threat to native ecosystems and agriculture. Ecologists have tried releasing *Cactoblastis*, but it has failed to establish for whatever reasons, and prickly pear continues its march in Africa. So, establishing the moth there might be beneficial, and we would support that effort. But its arrival in Texas is just about the worst-case scenario.”

Opuntia species, which number approximately 200, can prevent or reverse desertification and promote reforestation in arid areas.² Along with *Cylindropuntia* cacti, they also provide food and nesting sites for wildlife and contribute to soil stability.³ According to Stiling (2002), “*Opuntia* is used by a whole community of organisms,”

including mammals, birds, and at least 109 insect species in Mexico. For example, *Opuntia* is a food source for javelinas, a group of hoofed mammals.⁵

Gilbert remembers a multiyear drought when he was growing up in southern Texas in the 1950s. “After three or four years without rain, there was nothing, and prickly pear was the only thing that cows were surviving on,” he said. “People would burn the thorns off with a blowtorch so the cows could eat it. And then deer and all sorts of wildlife would start eating the pads before they were even cool. So, I grew up seeing prickly pear as a way to sustain wildlife and ranching in a drought-prone, semiarid ecosystem.”

In North America, prickly pear has been used and cultivated since pre-Columbian times. Remains of prickly pear fiber in human coprolites (fossilized feces) from the Lower Pecos region of West Texas suggest the cactus was a main

Two-thousand-year-old tattoo artifact from Turkey Pen shelter in southeastern Utah. The artifact consists of a wooden skunkbush sumac (*Rhus trilobata*) stem, yucca (*Yucca* spp.) split leaf wrapping, and two cactus spines that compare favorably (using scanning electron microscopy) to prickly pear (*Opuntia* spp.) spines and are stained at the tips. With radio carbon dating, the geological context of the artifact was dated to 79-130 CE, which reportedly makes it the oldest known evidence of tattooing in western North America. It is unknown which Native American tribe used the artifact.⁷

Credit: Robert Hubner, Washington State University.
Courtesy of Andrew Gillreath-Brown



food source for the area's inhabitants around 6000 BCE.⁶ A 2,000-year-old tattoo implement from Utah consists of plant materials including two cactus spines that compare favorably to prickly pear spines and is the oldest known tattooing artifact from western North America (see image).⁷

In the 16th century, Spanish Franciscan friar Bernardino de Sahagún wrote that Native Americans lived for many years partly because they ate uncooked foods like prickly pear fruits and pads.⁸ Also in the 16th century, Spanish explorer Álvar Núñez Cabeza de Vaca, the first European to explore present-day Texas, reportedly noted: "there are many kinds of *tunas* [*Opuntia* fruits] and among them some are very good, although to me they all seemed so and hunger never gave me time to choose."⁹

Opuntia ficus-indica is one of the most important cultivated prickly pear species and is vulnerable to the cactus moth. Its fruits, which mature in early fall, contain antioxidant pigments called betalains¹⁰ and are valuable for their high-water content. Because of their vitamin C content, the fresh fruits have been used to treat scurvy, a disease caused by vitamin C deficiency.¹¹ The cladodes, called *nopales*, often are canned or pickled¹ and are a good source of calcium and other minerals, pectin, proteins, and vitamins.¹² A 2014 study suggests that *O. ficus-indica* can reduce postprandial blood glucose and increase antioxidant activity in healthy people and patients with type 2 diabetes.¹³

In a 2010 study, Recovera® (Finzelberg GmbH & Co. KG, sister company of Martin Bauer Group; Andernach, Germany), a proprietary extract of *O. ficus-indica* cladodes and fruits, showed blood sugar-lowering effects in pre-diabetic men and women. This provides some support for the traditional use of the plant to treat type 2 diabetes, which is one of the leading causes of death in Mexico.¹⁴ Recovera also has been shown to support muscle function and recovery in various ways, including by modulating insulin response, stimulating nutrient uptake in cells, and boosting glycogen resynthesis, which restores muscles' ability to turn carbohydrates into energy.^{15,16}

In Mexico, *O. ficus-indica* is among the most economically important plants, along with blue agave (*Agave tequilana*, Asparagaceae) and maize (*Zea mays*, Poaceae). The cactus is a host plant for the cochineal insect *Dactylopius coccus*, a source of the red dye carmine. Carmine-dyed wool and cotton are important in Mexican folk art, and cochineal was the second-most valuable export behind silver for much of Mexico's history.¹⁷ One hectare of *O. ficus-indica* used for carmine production can generate an estimated \$15,000.¹⁸ The cactus moth jeopardizes this source of income. Because of its importance for food, carmine production, and more, prickly pear is depicted below the eagle on the Mexican flag and shield.¹⁷

However, some people view prickly pear negatively, maybe partly "because they've gotten tangled up with it, and it's not a pleasant sensation," Plowes said, but also some land-use practices exacerbate the density of prickly pear. When bulldozers or chain plows run through prickly pear habitats, the cladodes are fragmented and can regrow as individual plants, he said. So, instead of small patches



of prickly pear here and there, this can create a landscape dense with prickly pear below mesquite (*Prosopis* spp., Fabaceae) trees, making the land unusable for grazing, etc.

Plus, animals can lose weight from eating prickly pear fruits and develop ulcerations and infections from the spines when eating the cladodes.¹ These and possibly other factors may lead some people to welcome the cactus moth. In fact, according to Gilbert, there were reports that some people tried to introduce the moth into Texas in the early 2000s, but he and Plowes think that is "misguided" and urge that "education is needed here."

Wasp Versus Moth

The UT researchers emphasize the potential benefits of using biological control agents to address problems like the cactus moth. To control the moth in Texas, they plan to introduce a wasp species, *Apanteles opuntiarum*, which is native to the same areas of South America as the moth. The United States Department of Agriculture (USDA) research unit also has been testing the wasp to allow its release.



Prickly pear *Opuntia* spp.
Photo ©2020 Danil Bukharov

This tiny wasp is a co-evolved natural enemy of the moth and locates the moth by scent, according to Plowes. The wasp enters the cactus pad and injects its eggs into the moth larvae, parasitizing them, he said. The UT researchers hope that, after the wasp is introduced, it will spread with the moth and keep the moth controlled, but they do not expect the wasp to eradicate the moth.

Unlike chemical controls, biological controls like the wasp are organic and do not leave chemical residues, Plowes said. So, the prickly pear fruits and cladodes would still be safe for humans and animals to eat. According to some sources, no satisfactory method of chemical control is available for the cactus moth.^{1,3*}

A good biological control agent should meet several criteria, Plowes said. It should be target-specific, which often

means it has a close evolutionary connection with the target and needs to ignore most everything else in the landscape. “We don’t just want a predator that takes a bite and moves on,” he said. “It also has to be able to exert some sort of control. We don’t just want it to be a nuisance, like fleas on a dog.”

To be impactful, the control needs to overcome the defenses of the target. “There is an evolutionary argument as to why natural enemies are effective,” Plowes said. Then, it should be sustainable. “We don’t want to spend the rest of our professional lives breeding wasps and releasing them every year,” he added. “We would like to help establish the wasp and let it continue on its own.”

Partly because this wasp species is likely to be highly specialized, Plowes and Gilbert think it is unlikely that it

* However, according to Peter Felker, PhD, a prickly pear expert and reviewer of this article, the moth may be controlled in orchard settings by a combination of insecticides and cultural practices. While he was living in the native range of *Cactoblastis* in Santiago del Estero, Argentina, from 1998 to 2003, he discovered that by spraying infected cacti with the insecticide carbaryl (Sevin®) and a strong coadjuvant (penetrating agent), all the moth larvae inside the pads were dead 10 days after application. With the help of the penetrant, carbaryl apparently diffuses deep enough into the pads to kill the larvae, Felker said. He noted that carbaryl is currently registered for cochineal control. However, according to some sources, carbaryl can be toxic to humans, some fish, honeybees, and more. If prickly pear plantations are weed-free with no leaves or grass under the cacti for the moth to complete its life cycle, then the moth population is greatly reduced, Felker added.

will have any negative effects for other organisms in the environment. In laboratory tests overseen by the USDA, the wasp has been exposed to native Texas moths that are closely related to the invasive cactus moth. In all the testing so far, the wasp has not affected any of the non-target species, which indicates that it is an appropriate biological control, Plowes said.

“The worst outcome would be if [introducing the wasp] does not work,” Gilbert said. “These kinds of insects are often like antibodies. They are so specific. It is like getting a vaccine that is very specific to one virus. That is the way these insect parasitoids are. They are generally very target-specific, which is why we focus on them.”

Florida, where the invasive cactus moth was introduced previously, has its own native species of cactus moths with their own parasitoids, but these parasitoids do not seem to affect the invasive *Cactoblastis* moth, Plowes noted. “In a sense, this is a reciprocal test that shows how specific these parasitoids are,” he said. “You can go to Argentina, where *Cactoblastis* is native, find a particular parasitoid that attacks it there, and then bring it here and demonstrate that that specificity continues.”

Plowes and Gilbert are using pheromone traps to monitor the spread of the moth in Texas.¹ The traps help determine the limits of the moth invasion, where the invasion is most dense, what times of year the moth is present in specific areas, and more. “It is very much like testing the human population to see where COVID-19 is present,” Gilbert said. The pheromone traps will help determine ideal loca-

tions for releasing the wasps, how many wasps need to be released, and when the wasps should be released.

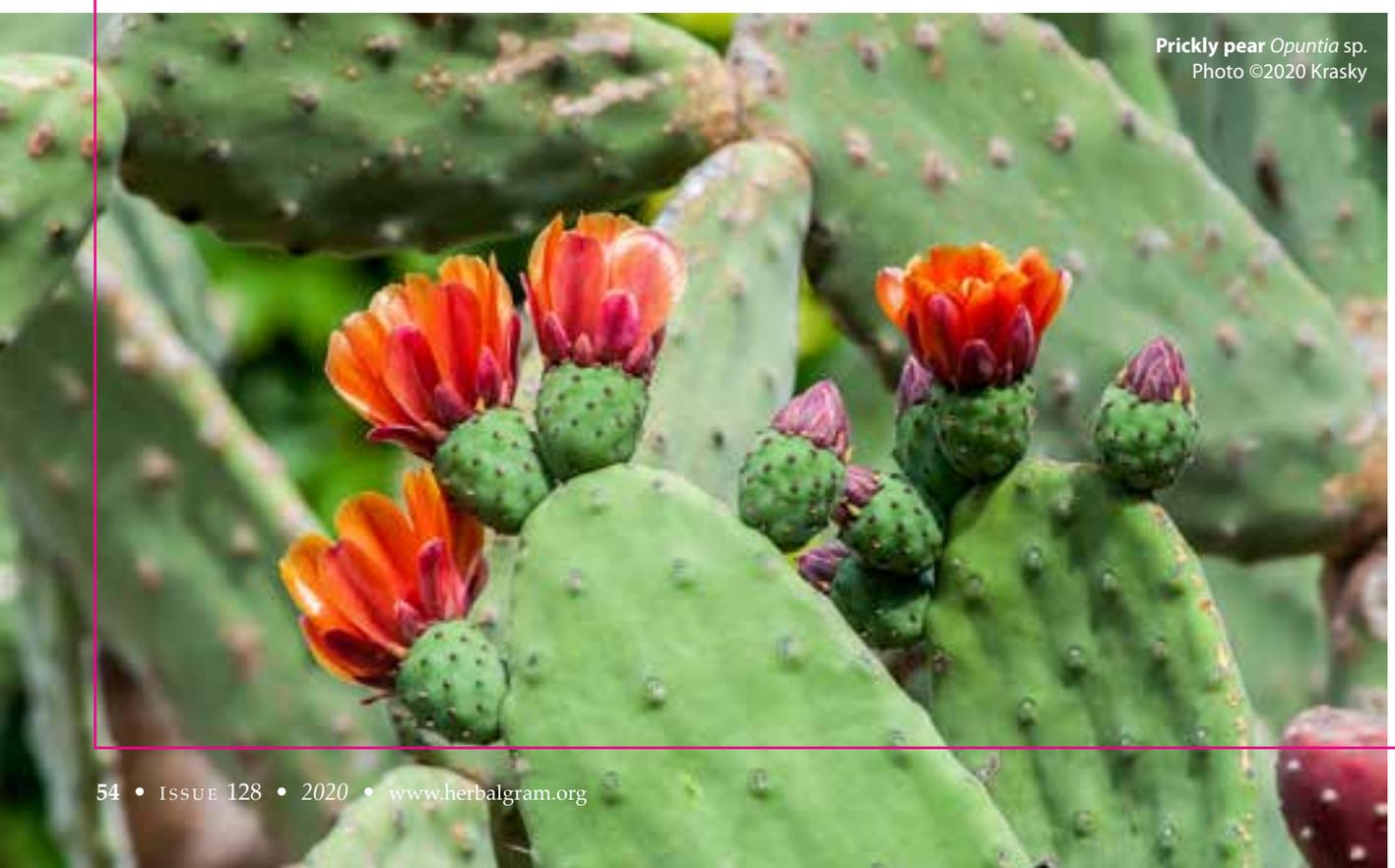
They hope to start releasing the wasp by summer 2021, but that depends partly on the COVID-19 pandemic and if they have enough funding. Gilbert estimates that a four-year program to introduce the wasp will cost about \$300,000 per year, and no state funds are available. They already have some funding from the Lee and Ramona Bass Foundation, a collaborative ConTex grant, and a Texas Ecolabs award but are seeking additional funding.¹

“We have to do this before the moth gets totally out of the box and gets into Mexico,” Gilbert said. “If we let this go [unaddressed for] two or three years, we are in big trouble.”

If the problem is not addressed soon, Plowes said, then it could create a situation like in Australia, where the moth decimated millions of acres of prickly pear. “We do not intend to lose 60 million acres of prickly pear [in North America],” he said. “At that point, it would not be necessary to introduce the wasp, because the moth will just crater on its own. We do not want to see it get to that point.”

This problem requires international solutions, according to Plowes. “The Mexican government has recognized the huge risk this moth poses and previously sent funding to the US to stop the spread of the moth toward Mexico,” he said. “We have collaborators in Mexico and Argentina. I think there is a consensus that introducing this wasp is the first phase of control. But, to introduce the wasp, we need to have permits from the US and Mexico, because the wasp could potentially spread to Mexico.”

“Cacti are essential in the diets of wild mammals, birds, and reptiles, for example. We want people to support biologically clean and sound options for controlling the cactus moth. This problem is also critical for Mexico because cactus pads are a basic component of the daily diet.”



Prickly pear *Opuntia* sp.
Photo ©2020 Krasky

Sergio Sánchez-Peña, PhD, a professor of entomology at Universidad Autónoma Agraria Antonio Narro in Saltillo, Mexico, is working with Plowes and Gilbert. “My role is to detect beneficial insects that attack caterpillars that are related to the cactus moth and have similar feeding habits,” Sánchez-Peña wrote (email, July 24, 2020). “These caterpillars already exist in Mexico, but they are not nearly as destructive as the invasive cactus moth. The objective is to investigate whether those beneficial insects that kill similar caterpillars will also attack the cactus moth if it arrives.”

“Cacti are essential in the diets of wild mammals, birds, and reptiles, for example,” Sánchez-Peña added. “We want people to support biologically clean and sound options for controlling the cactus moth. This problem is also critical for Mexico because cactus pads are a basic component of the daily diet. Biological control by beneficial organisms is the best option against the cactus moth, because these organisms propagate themselves. It is important that the United States and Mexico work together to approach ecologically sound control options for this significant pest.”

Controlling *Cactoblastis cactorum*

Female *C. cactorum* moths lay eggs on the cactus cladodes. About 75 eggs on average, and up to 140 or more, are stacked in a chain called an egg stick, which often resembles a cactus spine. After hatching, the larvae, which are orange to red with black bands, tunnel into the cladodes and consume most of the inside. After one cladode is eaten or decayed, the larvae may move to the next cladode.^{2,3,19}

As they feed, the larvae push frass (debris or excrement produced by insects) and mucilage out, creating a noticeable “ooze.” The cladodes may become yellow, translucent, and hollow. The larvae’s burrowing can also cause bacterial infection, which speeds up destruction of cladodes. Fully developed larvae leave the plant and spin silk cocoons, often in the debris of rotting cladodes and other nearby sites. The adult moths are seen rarely because they are active before dawn.^{2,3,19}

The female prefers to lay eggs on some *Opuntia* species, such as *O. engelmannii* varieties *engelmannii* and *linguiformis*. However, the female’s preferences are generally not a good indicator of the cactus species on which the larvae perform the best. In one study, *O. streptacantha* was one of the best hosts for larvae survival and development but not one of the most preferred by females. This mismatch may partly be explained by the new association between the cactus moth and North American *Opuntia* species. The moth likely has not had time to adapt to its new cactus hosts. The larvae do not fare well on *Opuntia* species with tough cladodes, such as *O. engelmannii* var. *lindheimeri* and *O. macrocentra*, because the larvae apparently have difficulty burrowing into them.^{3,20}

The moth was first detected in southern Florida on Big Pine Key in 1989. It may have dispersed naturally across the Caribbean or been introduced unintentionally on horticultural prickly pear cacti imported into Florida.² Since then, it has spread along the US Atlantic and Gulf coasts and can be found as far north as Charleston, South Carolina. Although the moth spreads more quickly along coasts, inland spread is also occurring.³



Cactoblastis cactorum larva in prickly pear (*Opuntia* sp.) cactus pad. Photo ©2020 Rob Plowes

Cactoblastis cactorum egg stick attached to prickly pear cactus pad. Photo ©2020 Larry Gilbert

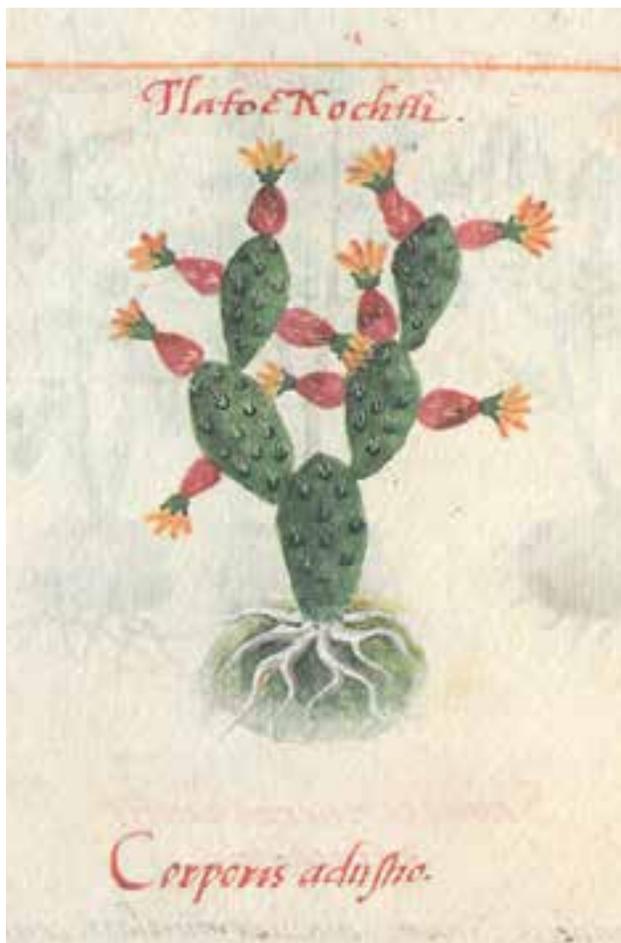


According to Stiling (2002), at least 31 *Opuntia* species in the US and 56 species in Mexico are “likely to be attacked by *Cactoblastis*.”⁵ According to Stiling et al (2004), Mexico has more than three million hectares (7.4 million acres) of wild *Opuntia* (an area roughly the same size as Belgium), with 56 species in the subgenus *Platyopuntia*, which may be attacked by the cactus moth. Thirty-eight of those species are endemic. And at least 250,000 hectares (617,763 acres) of *Opuntia* are cultivated for food for humans and livestock, fuel, and other purposes.²¹ In Mexico, these plants are valued at more than \$80 million annually.³

In Florida, the cactus moth threatens prickly pear species including *O. cubensis*, *O. stricta*, and *O. humifusa*, as well as rare species including *O. spinosissima*, *O. triacantha*, and *O. corallicola*.³ Endemic to the Florida Keys, *O. corallicola* reportedly is one of the rarest plants in North America. Only one population of this species with 13 mature cacti was known to exist when the moth arrived in Florida. In 1990, the cactus moth infested this population and killed one cactus, but the Nature Conservancy’s efforts have allowed the population to persist.²²

Manual removal of cactus moth egg sticks from cacti has helped control the moth in some commercial *O. ficus-indica*

Botanical illustration of prickly pear (*Opuntia* sp.) from the *Libellus de Medicinalibus Indorum Herbis* (1552), an Aztec herbal manuscript, also known as the Badianus Manuscript, the Codex de la Cruz-Badiano, and the Codex Barberini.



stands. According to Stiling (2002), this may be effective on *Opuntia* plantations in Mexico, if the moth arrives there, but it is impractical for wild cacti. Previously, in Florida, cages were used to protect prickly pear from the moth. However, cages prevent cross-pollination and may topple over during storms, which may damage or kill the cacti inside, so they are no longer used.⁵

Besides the wasp *A. opuntiarum*, which the UT researchers plan to release in Texas, other natural enemies of the cactus moth include the insect species *Apanteles alexanderi*, *Brachymeria cactoblastidis*, *Epicoronimyia mundelli*, *Phyticiplex doddi*, and *P. eremnus*. But these other insect species may also harm other non-target moth species.^{3,23}

Mahr (2001) suggests that “biological control of *C. cactorum* would, on the surface, seem to be an ironic but logical solution.”²⁴ And Pemberton and Cordo (2001) wrote: “the primary risk of employing biological control is the reduction of the many North American cactus moths, some of which probably regulate native *Opuntia* that can be weedy.... The relative benefits and risks of biological control need to be carefully assessed prior to any operational biological control programs.”²⁵ HG

References

1. Price A. Newly detected moth threatens prickly pear cactus in Texas. *Austin American-Statesman*. March 9, 2020. Available at: www.statesman.com/news/20200309/newly-detected-moth-threatens-prickly-pear-cactus-in-texas. Accessed September 17, 2020.
2. *Cactoblastis cactorum* (cactus moth). CABI website. Available at: www.cabi.org/isc/datasheet/10680. Accessed September 17, 2020.
3. Cactus moth. University of Florida website. Available at: entnemdept.ufl.edu/creatures/bfly/cactus_moth.htm. Accessed September 17, 2020.
4. Zimmermann H, Bloem S, Klein H. Biology, History, Threat, Surveillance and Control of the Cactus Moth, *Cactoblastis cactorum*. International Atomic Energy Agency website. Available at: www-pub.iaea.org/MTCD/publications/PDF/faobsc_web.pdf. Accessed September 17, 2020.
5. Stiling P. Potential non-target effects of a biological control agent, prickly pear moth, *Cactoblastis cactorum* (Berg) (Lepidoptera: Pyralidae), in North America, and possible management actions. *Biol Invasions*. 2002;4:273-281.
6. Maltzberger WA. Cactus as a resource. *J Prof Assoc Cactus Dev*. 1996:3-9.
7. Gilreath-Brown A, Deter-Wolf A, Adams KR, et al. Redefining the age of tattooing in western North America: A 2000-year-old artifact from Utah. *J Archaeol Sci Rep*. 2019;24:1064-1075.
8. Anaya-Pérez MA. History of the Use of *Opuntia* as Forage in Mexico. Food and Agriculture Organization of the United Nations website. Available at: www.fao.org/3/y2808e/y2808e05.htm. Accessed September 17, 2020.
9. Learning from Cabeza de Vaca. Texas Beyond History website. Available at: texasbeyondhistory.net/cabeza-cooking/inland.html. Accessed September 17, 2020.
10. Butera D, Tesoriere L, Di Gaudio F, et al. Antioxidant activities of Sicilian prickly pear (*Opuntia ficus indica*) fruit extracts and reducing properties of its betalains: Betanin and indicaxanthin. *J Agric Food Chem*. 2002;50(23):6895-6901. doi:10.1021/jf025696p.
11. Crop Ecology, Cultivation and Uses of Cactus Pear. Food and Agriculture Organization of the United Nations website. Available at: www.fao.org/3/a-i7012e.pdf. Accessed September 18, 2020.
12. Hernández-Urbiola MI, Pérez-Torrero E, Rodríguez-García ME. Chemical analysis of nutritional content of prickly pads (*Opuntia ficus indica*) at varied ages in an organic harvest. *Int J Environ Res Public Health*. 2011;8(5):1287-1295.

13. López-Romero P, Pichardo-Ontiveros E, Avila-Nava A, et al. The effect of nopal (*Opuntia ficus indica*) on postprandial blood glucose, incretins, and antioxidant activity in Mexican patients with type 2 diabetes after consumption of two different composition breakfasts. *J Acad Nutr Diet*. 2014;114(11):1811-8. doi: 10.1016/j.jand.2014.06.352.
14. Godard MP, Ewing BA, Pischel I, Ziegler A, Benedek B, Feistel B. Acute blood glucose lowering effects and long-term safety of OpunDia™ supplementation in pre-diabetic males and females. *J Ethnopharmacol*. 2010;130(3):631-634.
15. Van Proeyen K, Ramaekers M, Pischel I, Hespel P. *Opuntia ficus-indica* ingestion stimulates peripheral disposal of oral glucose before and after exercise in healthy men. *Int J Sport Nutr Exerc Metab*. 2012;22(4):284-291.
16. Deldicque L, Van Proeyen K, Ramaekers M, Pischel I, Sievers H, Hespel P. Additive insulinogenic action of *Opuntia ficus-indica* cladode and fruit skin extract and leucine after exercise in healthy males. *J Int Soc Sports Nutr*. 2013;10(1):45. doi: 10.1186/1550-2783-10-45.
17. *Opuntia ficus-indica*. University of Maine website. Available at: umaine.edu/littlefieldgarden/home/plants-in-the-greenhouse/opuntia-ficus-indica/. Accessed September 19, 2020.
18. *Opuntia ficus-indica*. NatureServe website. Available at: explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.150164/Opuntia_ficus-indica. Accessed September 19, 2020.
19. *Cactoblastis cactorum*. Cactus Moth. Texas Department of Agriculture website. Available at: www.texas-agriculture.gov/Portals/0/Files/ACP/PQ/Quarantines/Cactus_Moth_pamphlet.pdf. Accessed September 19, 2020.
20. Jezorek HA, Stiling PD, Carpenter JE. Targets of an invasive species: Oviposition preference and larval performance of *Cactoblastis cactorum* (Lepidoptera: Pyralidae) on 14 North American opuntioidei cacti. *Environ Entomol*. 2010;39(6):1884-1892.
21. Stiling P, Moon D, Gordon D. Endangered cactus restoration: Mitigating the non-target effects of a biological control agent (*Cactoblastis cactorum*) in Florida. *Restor Ecol*. 2004;12(4):605-610.
22. Hight SD, Carpenter JE, Bloem KA, Bloem S, Pemberton RW, Stiling P. Expanding geographical range of *Cactoblastis cactorum* (Lepidoptera: Pyralidae) in North America. *Fl Entomol*. 2002;85(3):527-529.
23. Srivastava M, Wolaver D. Argentine Cactus Moth Biological Control. Florida Department of Agriculture and Consumer Services website. Available at: www.fdacs.gov/Divisions-Offices/Plant-Industry/Science/Biological-Control/Argentine-Cactus-Moth-Biological-Control. Accessed September 19, 2020.
24. Mahr D. *Cactoblastis cactorum* (Lepidoptera: Pyralidae) in North America: A workshop of assessment and planning. *Fl Entomol*. 2001;84(4):465-474.
25. Pemberton RW, Cordo HA. Potential and risks of biological control of *Cactoblastis cactorum* (Lepidoptera: Pyralidae) in North America. *Fl Entomol*. 2001;84(4):513-526.



Prickly pear *Opuntia cespitosa*
Photo ©2020 Steven Foster

DNA TESTING METHODOLOGIES IN BOTANICAL QUALITY CONTROL PROGRAMS

By David L. Erickson, PhD

While the identities of ingredients in their whole forms, such as an apple (*Malus domestica*, Rosaceae) or a bulb of garlic (*Allium sativum*, Amaryllidaceae), often can be determined by physical appearance (macroscopic characteristics) alone, it is more difficult to discern the composition of processed foods, such as apple juice or garlic powder. The same is true for dietary supplement ingredients.

With the dizzying array of product choices, widespread reports of fraud, and the general difficulty of conveying high-quality ingredients on a product label, making informed purchasing decisions is no simple matter for consumers. When choosing dietary supplements for individual health needs, consumers often rely on products that are authentically produced and properly labeled. Regulations to ensure dietary supplement product integrity within the United States are generally appropriate, but concerns about ingredient safety and purity persist. DNA-based authentication tests, which continue to become less expensive, faster, and more accurate, are powerful tools to ensure food and natural product safety and consumer confidence.

The use of DNA data for the identification of natural products has been available for some time, with the earliest known report of DNA-based botanical authentication published by Shaw and But in 1995.¹ However, the prospect of its widespread application in commerce for quality control and as part of regulatory programs is new. To that end, understanding how DNA testing methods work and their relative strengths and weaknesses can help industry make informed decisions about the application and suitability of using DNA for product screening.

This article seeks to introduce the basic principles of DNA testing, provide a broad outline of different types of DNA tests, and suggest how DNA testing may work with other existing types of authentication processes to ensure the safety and authenticity of herbal dietary supplements. The purpose of the article is not to describe and compare all types of DNA tests but to help stimulate thinking about the use of these methodologies, highlight some of their strengths and limitations, and clarify some misunderstandings. Although this article focuses on herbal dietary supplements, the principles of DNA testing are generalizable to any naturally derived product for which there is sufficient DNA.

Why Use DNA?

Before the move to embrace DNA testing, many other methods were available to evaluate natural products. Modern pharmacopeias are brimming with different tests (e.g., macroscopic, microscopic, and chemical analyses) that have been evaluated and applied to a wide range of natural products, especially botanical ingredients. DNA methods are different from those tests because DNA is the part of an organism that defines its heredity. While many different characteristics can be used to identify and distinguish



Figure 1. The Tree of Life

A molecular phylogeny of the “tree of life,” with Bacteria and Archaea domains (single-celled organisms) collapsed. What unites these diverse clades is not chemistry, physiology, or morphology but a shared heredity, an unbroken chain of connection forged by our genetic code. That code defines each lineage (kingdom or family, or genus or species) and, as such, DNA is the determinant of each species’ lineage. This means DNA is the ultimate source of data to identify and differentiate the things we call species.

Illustration credit: The Interactive Tree of Life and the Noun Project



species — chiefly morphology (the structure of an organism) but also chemistry, geography, and behavior (i.e., characteristics related to growth and reproduction) — those characteristics must be heritable, and hence determined by their DNA, for the species to be evolutionarily distinct. One common definition of a species is a group of individuals that shares a common ancestor and is linked by a shared heredity (Figure 1). The chain of heredity is organized into taxonomic levels (e.g., species, genera, and families), but at each level the shared heredity of the members of those groups defines them. DNA is the measurable part of organisms that most directly defines what is shared among those taxonomic groups. This has always been true, but DNA testing is being used more widely now for its increased ease of use, lower cost, and rapid application.

It is important to note that while DNA is most directly associated with discerning the evolutionary identities of species, DNA does not answer all questions related to the authenticity or safety of herbal dietary supplements. Dietary supplements are valuable because of the biologically active substances they contain, and DNA testing cannot measure these substances. A dietary supplement that contains the DNA of a medicinal plant but none of the medicinal compounds would have no value to consumers. DNA also cannot be used to screen for the presence of dangerous chemical additives (e.g., the pigment lead chromate that is sometimes used to color turmeric [*Curcuma longa*, Zingiberaceae]). As such, DNA testing alone will not ensure that products are effective or safe to consume. Another issue is that DNA cannot distinguish among different plant parts, since the exact same DNA is in every cell of an organism. While genes are expressed differently in different tissues, the ability to quantify those differences in processed materials does not appear to be practicable at this time. Given these limitations, DNA testing should be part of an overall toolkit that also includes chemical analysis and morphology to ensure the authenticity, purity, and safety of dietary supplements.

Putting It into Practice

With the streamlined processes for DNA sequencing and the proliferation of commercial kits that enable DNA recovery from products, it is not difficult to recover DNA sequence data. Instead, the challenge lies in the correct

interpretation of that data. Good examples in the published literature include methods that can be readily reproduced in other laboratories, help define boundaries in which DNA tests may be less effective, and employ DNA and chemistry jointly.^{2,3}

The now-infamous New York attorney general investigation,⁴ which asserted widespread fraud in the dietary supplement industry based on DNA analyses of various products but failed to report how the results were obtained, is an example of what not to do with DNA-based testing. Similarly, some reports at conferences have suggested widespread substitution of authentic materials with toxic ingredients (e.g., bindweed [*Convolvulus arvensis*, Convolvulaceae]),⁵ where the results were more consistent with accidental field or laboratory contamination than with actual commercial malfeasance. These erroneous reports threaten to undermine trust in the use of DNA as a part of quality assurance programs.

Given the central role that genetics plays in determining species, DNA testing is appropriate when employed correctly, but it must be conducted in a standardized fashion using transparent, repeatable methods. Only then will it be valuable to both producers and consumers.

Classes of DNA Tests

A wide diversity of DNA methods can infer or directly read DNA sequence data from material, and this diversity can make it difficult to choose the most suitable method. DNA tests typically belong to one of two broad categories: one will generate DNA amplification products (copies of a region of DNA) of a known diagnostic size, while the other will directly read the DNA sequence data. Some of these differences are summarized in Tables 1 and 2 on page 61.

Methods that infer DNA sequence data include quantitative polymerase chain reaction (qPCR) and barcode DNA-high resolution melting (Bar-HRM), species-specific PCR, random amplification of polymorphic DNA (RAPD), and amplified fragment length polymorphism (AFLP). These methods generally deliver faster results and incur lower costs than those that directly capture and read DNA from a sample. However, they are based on the assumption that the test works every time that the species is present in the sample (i.e., no false negatives), and that the test always distinguishes among closely related species correctly. Because

Reading the Book of Our DNA

To understand the basics of DNA testing, it is helpful to think of DNA as an instruction manual. An instruction manual does not do any work — it only provides the guidance for the work. Similarly, an organism's DNA does not do any work but contains the instructions for the cells to do the work that makes the organism function.

To continue with the analogy, an instruction manual contains different combinations of the 26 letters of the English alphabet, which are organized into words, sentences, chapters, and, ultimately, a book. DNA also has an alphabet (A, T, G, and C, known as nucleotides) and those letters are combined into genes, genes into chromosomes, and chromosomes into our genome — the book of our living heredity. Just as the set of letters, words, sentences, and chapters that make up an entire book is unique to each book, so too the combination of nucleotides, genes, and chromosomes is unique to every living species, and, indeed, every individual has its own unique DNA book.

So, if we can read the book of an organism's genome, we can identify the organism and distinguish it from other living organisms. Legions of technical methods can be used to read the DNA of a living species, but ultimately the use of DNA sequence data in the authentication of products is based on finding and reading a distinct set of A, T, G, and C that is unique to the species under consideration.

DNA testing can be used to either detect the presence of DNA that is unique to one species only (a binary approach) or recover and classify DNA data from all species that may be present in a sample (a metagenomic approach).

such tests never capture any direct sequence data from these methods, the threshold for validation needs to be high to ensure that inference methods provide correct results when testing highly processed foods.

Methods that directly capture sequence data (e.g., DNA barcoding, metabarcoding, shotgun or amplicon metagenomics) make fewer assumptions about the identities of the products. If sequence data are captured that match a combination of A, T, G, and C unique to a species, then that material can be correctly identified. Still, one must conduct due diligence to ensure that the DNA data can in fact distinguish the target species. At a bare minimum, if the DNA data perfectly match one or several of the same reference sequences, one can at least conclude that the data are fully consistent with that species being present. The other critical advantage of reading DNA directly is that when combined with high-throughput sequencing (HTS),* which is now the standard, one can estimate the relative purity of samples and, by extension, the relative proportions — something that cannot be done using methods based on inference. While a number of factors may affect the absolute estimate of relative proportions of species in a mixture, these factors may be explored and quantified such that it is known how much input of a product that has been processed in a given way produces how much DNA in a finished product. The inference of the relative proportion of ingredients ultimately remains a work in progress, and substantial efforts at validation are needed.

Managing the Trade-offs

Several critical factors are weighed when choosing an appropriate DNA test, including cost, speed, accuracy, power, and scope. The first question that must be answered when choosing a DNA test method relates to the scope of the analysis. DNA testing can be used to either detect the presence of DNA that is unique to one species only (a binary approach) or recover and classify DNA data from all species that may be present in a sample (a metagenomic approach). With a metagenomic approach, DNA recovered from a product is compared to a reference database containing DNA signatures from many species, allowing one to jointly determine identity and purity. These two approaches have different strengths and weaknesses and are based on different assumptions. Some of these issues are highlighted in Table 1, which outlines a few of the most common techniques, where they fit in the binary/metagenomic scheme,

and their relative speed, cost, and scope. The discussion below is not exhaustive of all DNA-based approaches and instead seeks to lay out two alternative visions with contrasting strengths and assumptions.

Binary approach

In general, binary tests use PCR to capture a very small region of the genome that is deemed unique and diagnostic to the species under consideration. That means due diligence has been conducted to determine what the most common botanical substitutions might be, how much genetic variation exists within the species, and how robust the exact test is under a range of processing conditions. Methods such as species-specific PCR, or its close relative qPCR, are predicated on a few changes in the A, T, G, and C sequence of the commercial species such that the PCR only works on that species and never works in its absence. No actual DNA sequence information is ever acquired; rather, the presence of a unique and diagnostic sequence is inferred through the success of the PCR, typically measured via fluorescence, but in some cases as variation in the number and size of DNA fragments, much like in thin-layer chromatography (TLC).

Such approaches may have difficulty when a declared ingredient is diluted within a sample, since they can deliver a binary “yes” when the intended ingredient is very rare. These methods may also produce false negatives if the DNA is degraded or if the DNA solution contains enzymatic inhibitors due to a failure of the PCR (failure of the enzymatic PCR implies the DNA of the plant is missing). Some of these problems can be avoided with appropriate controls. Development of assays that target ever-smaller pieces of DNA (e.g., “mini-barcoding”) may be able to be applied to increasingly processed products, but the trade-off is that less DNA is used in any single assay and, as such, may be less specific to that species. Also, binary tests provide no information as to the purity of a product. A separate assay needs to be developed for each species, and proving the method only works when the target species is present is not a trivial endeavor. Alternatively, such PCR-based assays can be very sensitive with very low detection thresholds and, as such, more useful for processed products.

Binary tests based on qPCR are currently used most often in food safety and medicine. With sufficient due diligence to determine if the assay is legitimately unique to the species to be identified, binary tests are a rapid and low-cost approach to confirm the presence of a botanical ingredient.

* Although “next-generation sequencing” (NGS) is still widely used as an overarching term for post-Sanger DNA sequencing methods, many prefer the term “high-throughput sequencing” (HTS). NGS is no longer the newest type of sequencing. For example, long-read sequencing or third-generation sequencing is now routinely used for DNA barcoding initiatives.



Table 1. Examples of DNA Authentication Methods

Species-Specific PCR⁶	Use of polymerase chain reaction (PCR) in combination with primers that match only a single species and which will produce a visible product in the presence of the correct species, or no product when the species is absent. Relies entirely on the specificity of the primers and assumes DNA is sufficiently intact. No PCR amplification means the product is absent.
Quantitative PCR (qPCR)⁷	Use of PCR in conjunction with fluorescent dyes or probe that results in increasing fluorescent signal with increasing product of the PCR product. Assumes primers or probe match only a single species and that DNA is sufficiently intact. Can compare the copy number of target DNA relative to a standard.
AFLP/RAPD⁸	Amplified fragment length polymorphism (AFLP)/random amplification of polymorphic DNA (RAPD) are genetic fingerprinting techniques that attempt to sample regions throughout the genome using PCR and a suite of primers that bind and allow PCR amplification of many regions to provide an array of product sizes that produce a diagnostic set of fragments. Much like TLC or HPLC, AFLP and RAPD produce a one-dimensional array of products. The number and relative size of the set of fragments can be diagnostic. Notoriously difficult to reproduce results among laboratories and probably unsuitable to highly processed materials. Largely outdated with the advent of inexpensive DNA sequencing.
DNA Barcoding	Use of a limited set of genetic regions (ideally one) that are PCR amplified using the same PCR primers for any species. Allows for construction and curation of large reference databases. When the sequencing is conducted with Sanger technology the cost is low, but this method is not necessarily diagnostic to the species level in plants. Assumes primers work for all species, may fail to PCR amplify more highly processed samples, and fails to resolve mixtures when used with Sanger sequencing technologies.
MLST⁹	Multilocus sequence typing (MLST) is similar to DNA barcoding but extends testing to include multiple regions to be PCR amplified and sequenced. Includes same assumptions and benefits as DNA barcoding, but improves rates of identification with concomitant increase in cost of sequencing multiple regions.
Amplicon Metagenomics¹⁰	Amplicon metagenomics is an extension of DNA barcoding (or MLST) to conduct sequencing on NGS instruments using PCR to amplify one or a few regions that are then sequenced. Allows for same benefits and assumptions as DNA barcoding or MLST, but due to the nature of NGS, amplicon metagenomics allows for a direct count of the number of copies of DNA that can be assigned to many species. As such, it offers the potential to quantify the concentrations of plants in mixtures and provide inference of purity.
Shotgun Metagenomics¹¹	Shotgun metagenomics uses DNA collected from a sample that has not been enriched or modified by PCR or another method. A large, random fraction of the DNA is sequenced and then compared to reference sequence databases that, increasingly, consist of entire genomes (e.g., chloroplast genomes). Ameliorates concerns related to success or failure of PCR and takes advantage of the many diagnostic characteristics that differentiate entire genomes. Requires more DNA than PCR-based approaches and is more time- and resource-intensive (i.e., costly).

Table 2. Summary of Representative Types of DNA Authentication Methods⁶⁻¹¹

Method	Cost*	Speed of Results (days)	Inference of Purity	Statistical Confidence
Species-Specific PCR	Low	1	No	None
qPCR	Low	1	No	None
AFLP/RAPD	Low	1	No	None
DNA Barcoding	Moderate	2	No	Moderate
MLST	Moderate	2	Yes	Moderate
Amplicon Metagenomics	Higher	3-4	Yes	High
Shotgun Metagenomics	Highest	3-4	Yes	Highest

* Average prices range from \$25 to \$300.

Metagenomic approach

Metagenomic-based tests are a newer development, and there is a tremendous recent push to develop software that interprets DNA data. The principle of metagenomic approaches is founded on the idea that DNA sequencing is affordable and will continue to get less expensive. Metagenomic approaches generally take the path of recovering data from one or many parts of the genome that are isolated from an ingredient, and then classifying and summarizing results.

The advantages of this approach are that DNA sequence data are acquired and the actual sequence of A, T, G, and C is read for one or many parts of the genome. In this sense, the identity of the ingredient is not inferred and is instead determined directly. Increasingly, the reference databases that are used to distinguish among species use multiple genomic regions or entire genomes to distinguish among species (e.g., whole chloroplast genomes, or, for probiotics, the entire bacterial genome), vastly improving the accuracy of the identifications and ameliorating concerns about the small number of sequence characters used to underpin binary tests. Another advantage is that the same laboratory method can be applied for nearly all products, which helps simplify workflows, allows for increased automation, and eliminates concerns as to whether the correct test was used. Lastly, these approaches provide a strong framework for statistical analyses of the results, such that probabilities (*P* values and confidence intervals) can be assigned to the results, providing a direct statement as to the quality of the identification.

Metagenomic approaches are limited by the cost and time, which are both greater than for binary tests. Another important issue is that for most implementations, more DNA must be available to be isolated from the product, which may limit the use of metagenomic approaches for highly processed products. This means that metagenomic approaches will likely only work well at early stages of ingredient processing in which they can provide confirmation of identity and purity,

while binary PCR-based species-specific assays will work better on more highly processed materials.

To Test the Tests

The question is not whether DNA can contribute to quality testing programs — it certainly can. Instead, the current challenge is that there are so many different types of DNA-based tests with different strengths and weaknesses, and, in contrast to animal DNA testing, it often is unclear what type of test fits best for plants. Even after deciding between a species-specific or metagenomic approach, there remain numerous options within each of those two general test methods.

In a sense, genetics is a victim of its own success. The proliferation of different tests reflects the success of DNA-based assays to answer a broad array of questions. Given this, what is needed are inter-laboratory trials that employ an agreed-upon set of methods to determine their precision, reproducibility, and cost. A recent program sponsored by the US National Institute of Standards and Technology (NIST) demonstrated how badly standardization is needed, with results from different organizations leading to a wide range of conclusions.¹² Using the same test samples produced results that rival those of the New York attorney general investigation⁴ in which many rare contaminants were incorrectly identified as an important part of the sample. Validation trials, such as the AOAC Performance Tested Methods validation, are useful, but these do not directly compare the performance of different approaches. As such, even if an approach is successful in a validation trial, it does not mean that approach is actually better than other approaches, and the trial may well establish a very narrow range of conditions within which validation is achieved. A merging of the NIST and AOAC approaches, in which an agreed-upon set of DNA methods are jointly employed using the same test materials, would be a step toward standardization. Using such an approach would allow the analytical community to begin to form a more objective conclusion about the accuracy, repeatability, and cost of different methods.

Reference Materials

For any of these diverse DNA methods to work, a set of accurate reference materials is needed that represents the products to be identified. For foods and botanical products, the sequences included in reference databases (e.g., GenBank) frequently are the best source for reference materials. If the database is poor (low species diversity, erroneous entries, absence of impor-

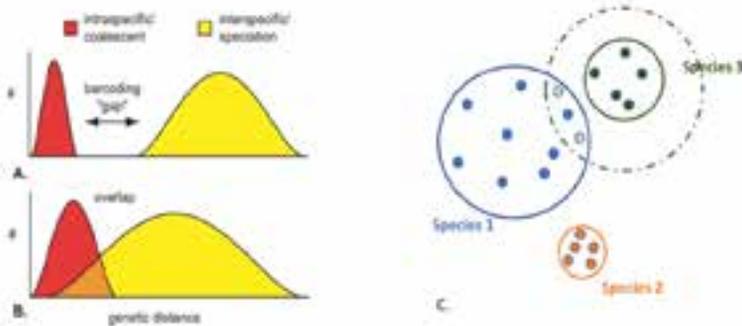


Figure 2. Graphical Representation of the DNA Barcoding Gap

The contrast here is the amount of genetic variation within a species and whether that variation overlaps with related species. When the variation within a species does not overlap with its closest relatives (part A), we can confidently differentiate two species. Alternatively, if the genetic distance within species overlaps with its closest relatives (part B), we have little or no confidence that we can differentiate among species. In part C, we see three species represented by area representing their genetic variation. Filled circles are individual representatives of that species used to infer the genetic variance. Packing more samples into the area for Species 2 is unlikely to change much, but the concern is the poor sampling for Species 3 (where the partially filled circles represent yet unsampled individuals) would suggest no overlap, but improved sampling might.



tant information, etc.), the best technology in the world will not help. The most common type of reference sequences are DNA barcodes — these are the minimum data content that provide a relatively high level of diagnostic power to identify species (see Figure 2). While the officially recognized DNA barcodes^{13,14} can provide useful information on the identity of a plant, these barcodes do not work as well across a wide range of plants, contrary to animals or fungi. Officially recognized barcodes correctly identify plant species about 75% of the time, and that is likely an overestimate.¹⁵

As a result, many authors have begun sequencing and making entire chloroplast genomes for plants publicly available. The chloroplast genome is the remaining genome of a bacterium that was captured and converted from a free-living cyanobacterium to a symbiotic organelle within plant cells. The chloroplast genome is approximately 100 times larger than the combined two-genomic region plant DNA barcode, and accordingly delivers much higher rates of diagnostic resolution (approaching 95% for most groups of plants). However, it will provide only the genetic information from the maternal parent, which means that additional information from nuclear or mitochondrial regions may be warranted when investigating recent hybrid species. While it is true that the chloroplast genome only contains information inherited from the maternal side of the plant, it is large enough that diagnostic mutations can be found to distinguish nearly all species from one another.

The process of capturing these data is well established, and publication of these data in GenBank or other public data repositories represents the commitment to transparency that is needed to ensure a safe and authentic supply of food and botanical dietary ingredients. While nearly any DNA data can be published in GenBank, data that are maintained and curated within discrete BioProjects (e.g., GenBank BioProject PRJNA515225) and which are linked to vouchers are much more reliable, as are records maintained in the RefSeq public database of nucleotide and protein sequences. It is worth noting that the publication of these data will assist in the development of any type of DNA-based assay (species-specific or metagenomic), and most professional herbaria are willing to share access to vouchered plant material if the recovered data are made freely available.

Conclusion

The use of DNA testing in quality control programs can help ensure the authenticity, purity, and safety of food and herbal products. As with all new technologies, DNA analytical methods need to be evaluated and ultimately validated. Concerns that DNA methods are too complex and redundant with existing chemical methods echo concerns of the past, as when high-performance liquid chromatography (HPLC) was first introduced. DNA data are uniquely suited to confirming species identity, since species are defined by their genetic lineage. The way that DNA can simultaneously be used to infer authenticity and purity is novel to DNA-based tests and allows these methods to complement chemical methods that identify bioactive constituents. The decision to implement a narrower species-specific assay or a broad-based screen in a validation program will need to be considered carefully. Ultimately, use of DNA data will be

employed in conjunction with chemical and morphological assays to demonstrate to consumers that producers have made a commitment to quality. HG

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References

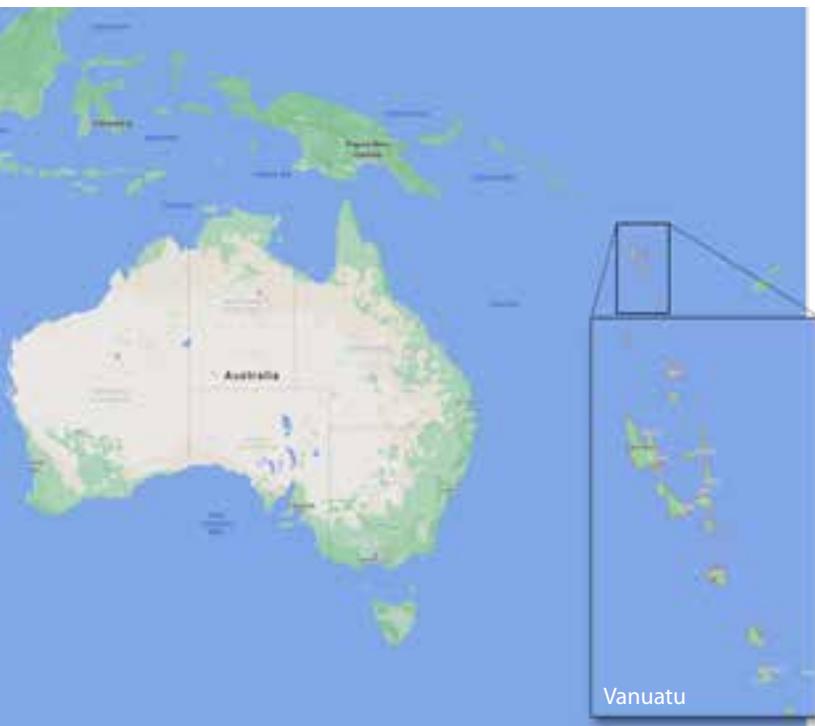
1. Shaw PC, But PP. Authentication of *Panax* species and their adulterants by random-primed polymerase chain reaction. *Planta Med.* 1995;61(5):466-469. doi: 10.1055/s-2006-958138.
2. Pawar RS, Handy SM, Cheng R, Shyong N, Grundel E. Assessment of the authenticity of herbal dietary supplements: Comparison of chemical and DNA barcoding methods. *Planta Med.* 2017;83:921-936. doi: 10.1055/s-0043-107881.
3. Ivanova NV, Kuzmina ML, Braukmann TWA, Borisenko AV, Zakharov EV. Authentication of herbal supplements using next-generation sequencing. *PLoS One.* 2016;11(12):e0168628. <https://doi.org/10.1371/journal.pone.0156426>.
4. A.G. Schneiderman asks major retailers to halt sales of certain herbal supplements as DNA tests fail to detect plant materials listed on majority of products tested [press release]. Albany, NY: New York State Attorney General's Office; February 3, 2015. Available at: www.ag.ny.gov/press-release/ag-schneiderman-asks-major-retailers-halt-sales-certain-herbal-supplements-dna-tests. Accessed April 1, 2019.
5. Daniels S. Adulteration with bindweed: A big concern that nobody is talking about? NutraIngredients-USA. September 25, 2016. Available at: www.nutraingredients-usa.com/Article/2016/09/26/Adulteration-with-bindweed-A-big-concern-that-nobody-is-talking-about. Accessed April 1, 2019.
6. Wallinger C, Juen A, Staudacher K, et al. Rapid plant identification using species- and group-specific primers targeting chloroplast DNA. *PLoS One.* 2012. <https://doi.org/10.1371/journal.pone.0029473>
7. Die JV, Roman B, Flores F, Rowland LJ. Design and sampling plan optimization for RT-qPCR experiments in plants: A case study in blueberry. *Front Plant Sci.* 2016. <https://doi.org/10.3389/fpls.2016.00271>.
8. Smith NR, Trigiano RN, Windham MT, et al. AFLP markers identify *Cornus florida* cultivars and lines. *J Am Soc Hortic Sci.* 2007;132(1):90-96. <https://doi.org/10.21283/JASHS.132.1.90>.
9. De las Rivas B, Marcobal A, Muñoz R. Development of a multilocus sequence typing method for analysis of *Lactobacillus plantarum* strains. *Microbiol.* 2006;152(1):85-93. doi: 10.1099/mic.0.28482-0.
10. Prado M, Ortea I, Vial S, Rivas J, Calo-Mata P, Barros-Velázquez J. Advanced DNA- and protein-based methods for the detection and investigation of food allergens. *Crit Rev Food Sci Nutr.* 2016;56(14):2511-2542. <https://doi.org/10.1080/10408398.2013.873767>.
11. Raime K, Krjutskov K, Remm M. Method for the identification of plant DNA in food using alignment-free analysis of sequencing reads: A case study on lupin. *Front Plant Sci.* 2020. <https://doi.org/10.3389/fpls.2020.00646>.
12. Barber CA, MM Phillips, CA Rimmer, et al. *Dietary Supplement Laboratory Quality Assurance Program: Exercise O Final Report.* 2019. <https://doi.org/10.6028/NIST.IR.8266>.
13. CBOL Plant Working Group. A DNA barcode for land plants. *PNAS.* 2009;106(31):12894-12897.
14. Schoch C, Seifert K, Huhndorf S, et al. Nuclear ribosomal internal transcribed spacer (ITS) region as a universal DNA barcode marker for fungi. *PNAS.* 2012;109:6241-6246. <https://doi.org/10.1073/pnas.1117018109>.
15. Hollingsworth PM, Graham SW, Little DP. Choosing and using a plant DNA barcode. *PLoS One.* 2011;6(5):e19254.



Borogu kava (*Piper methysticum*) on Pentecost Island, Vanuatu.
Photo ©2020 Chris Kilham

The Rising and Falling Fortunes of Vanuatu Kava

By Chris Kilham



In February 2020, I traveled to Vanuatu in the South Pacific to gain a better understanding of the kava (*Piper methysticum*, Piperaceae) trade in that country at this time. Kava, a medicinal plant prized for its sedative, anxiolytic, and anti-stress effects, is a major commercial crop in Vanuatu, serving both a consistent domestic market and a vigorous export trade. I have a long history of kava work in Vanuatu, dating back to 1995, and played a role in the formation of the international kava trade at that time. I have traveled to Vanuatu 15 times and was the country's Honorary Consul to the United States from 1997 to 2000. In that capacity, I focused on trade, specifically educational and promotional efforts related to Vanuatu kava and tamanu oil (*Calophyllum inophyllum*, Callophyllaceae).

My most concentrated years of activity in Vanuatu were between 1995 and 2005. During that time, I worked with kava on behalf of Pure World Botanicals (later purchased by Naturex and now part of Givaudan) and in close alliance with a Vanuatu-based Tahitian named Ariipaea Salmon. I chronicled some of that period in my book *Kava: Medicine Hunting in Paradise* (Park Street Press, 1996). My last trip to Vanuatu before this one was in April 2012.

On projects investigating medicinal plants, I invariably work with traders, as they have the best and broadest connections to growers, government officials, shippers, and various promotional and other programs associated with plants. From previous visits to Vanuatu, I knew some of the 24 registered kava exporters operating in Vanuatu today. Among them, 14 traders operate out of the capital of Port Vila, seven out of Espiritu Santo, and one on the isle of Pentecost. Three of the best-known kava exporters among the Vanuatu business community are Frank King, John Fordham, and Michael Louzé.

For this trip, I reached out to Michael Louzé, who runs his own kava trading business, South Seas Commodities, in Port Vila. Michael and I had met on three previous occasions: Once at the home of a mutual friend, once when he was working with trader Peter Colmar, and once on Pentecost, which lies to the north of the capital island Éfaté.

Michael is chairman of the Vanuatu Kava Industry Association. He has operated South Seas Commodities since 2010 and had worked in the trade for seven years before that. South Seas Commodities operates a sanitary warehouse near the airport outside of Port Vila on Éfaté, convenient to government inspection and air shipping facilities. Much of the information presented here is based on my conversations with Michael as we moved about in Vanuatu. Michael also developed the Kava World platform (kava-world.com), a nexus for kava activity in Vanuatu.

Noble Kava

Noble kava varieties are preferred drinking kavas for their rapid onset of effect, pleasant promotion of tranquility, hours of relaxation, and absence of nausea or headache. Noble varieties also conform to certain relative values of kavalactones, the active relaxing constituents in kava root. Eighteen kavalactones have been identified in kava. The primary six kavalactones are kavain, dihydrokavain, methysticin, dihydromethysticin, yangonin, and demethoxy-yangonin, composing about 95% of the kavalactone content. Noble varieties are highest in kavain and dihydrokavain, and low in demethoxy-yangonin.¹ This combination produces the pleasant effect for which noble kava is known.

Preparing a kava (*Piper methysticum*) drink.
Photo ©2020 Chris Kilham



Village *nakamal* (kava bar) at Lonfis, Pentecost Island.
Photo ©2020 Chris Kilham

South Seas receives noble kava roots (see “Noble Kava” sidebar) that are pre-cleaned, peeled, cut, washed, and sun-dried. Solar dryers on Pentecost island, many of them supplied by South Seas, have made a critical difference in the quality and quantity of the company’s kava supply. On any given week, South Seas will receive 10-20 bags of dry kava weighing approximately 25 kilograms (55 pounds) apiece. Once the kava arrives at South Seas, it undergoes a thorough inspection and pressure washing with filtered water and more sun-drying. Small pieces of stem, any root-stock pieces with dark centers, or other suspicious pieces are rejected. Michael estimates that he loses about 15% of value for the kava he buys from the time agents purchase



kava on Pentecost to the time he exports clean roots and root chips, and has built this loss into his profit margins.

At the time of my trip in February 2020, Vanuatu was going through about 40 tons of kava per week in its *nakamals* (kava bars), according to Michael. About 90% of all kava produced in Vanuatu goes directly to nakamals, dwarfing export sales. Still, the kava export trade is significant and valuable to the Vanuatu economy and culture. Vanuatu had a gross domestic product of \$914 million in 2018, according to government figures.² In 2019, Vanuatu exported a total of 819 tons of kava, generating revenues of 834 million Vatu, or just over \$7 million. According to tallies from the Vanuatu Kava Industry Association, the average freight-on-board (FOB) export price from Port Vila for noble kava root (cut, cleaned, dried, and sorted) currently is around \$40 per kilogram (kg). The largest quantities of kava for export go to Nouméa, New Caledonia, and Suva, Fiji. In both places, Vanuatu kava fuels a large and popular kava bar market.³

With high demand and a brisk trade, growers finally have achieved prices that make them a good profit. At \$20-\$25 per kg dry weight of noble kava (washed, peeled, and sun-dried), the Ni-Vanuatu (the indigenous popula-

tion of Vanuatu) are buying boats and improving their living conditions. The substantial price for growers is what my friends and I had hoped for in 1995 when we first helped start the kava trade. The people are doing well and supporting their families and communities. Manufacturers of kava extract that formerly applied intense downward pressure on kava prices now have less sway and must pay a fair price or do without Vanuatu kava.

Many things have changed in Port Vila, the bustling heart of Éfaté. Traffic is now heavily congested through the center of town. Cars, trucks, hire buses, and taxis cram the area, creating much exhaust. The central open market in Vila is more crowded, and numerous new resorts and hotels in and around town have been built.

In relation to kava, a few notable changes have occurred since my last trip to Vanuatu. These include the opening of the Anabru kava market, the introduction of kava bars with multiple windows, the selling of kava and beer together, the elimination of the Vanuatu Commodities Marketing Board (VCMB), and the abolition of tudei kava exports.

On the outskirts of Port Vila, people from many islands rent small spaces at the Anabru market, where they sell their own kava. Anabru looks like a rustic little motel, one long building with multiple small rooms. Vendors with both large and small amounts of kava can sell at Anabru. Some vendors sell two or three sacks' worth of kava, while others sell entire truckloads. Many of the smaller local kava bars around Port Vila get their kava at Anabru market, choosing from kava varieties from Espiritu Santo, Malekula, Pentecost, and Epi islands. Michael and I visited Anabru market a couple times. Overall, the kava appeared of low quality, poorly cleaned, and unpeeled or inadequately peeled. But the prices were low, averaging around 700 Vatu (\$6) per kg. Buyers bring kava from Anabru back to their nakamals, wash and peel it, and give it a final washing to make a good drinking kava that tastes clean and fresh.

Kava bars with multiple windows were a new feature to me. I used to go to the kava bar Ronnie's in the sector 2 district in Éfaté, a popular and reliable place. But now, instead of one window with one type of kava, Ronnie's has at least three windows with preparations from different kava varieties and makers. At one window, Melomelo kava from Ambae Island may be offered, and at another, Borogu kava from Pentecost. Just as people prefer different brands and types of beer, kava drinkers may prefer one variety of kava over another.

At the various kava bars we visited during my time in Vanuatu, coconut shells have been replaced by ceramic bowls. It used to be that a small coconut shell filled with kava would cost 50 Vatu, and a large shell would cost 100 Vatu. Now, the amount of kava that gets ladled into a bowl determines the cost. Customers may buy a small 50-Vatu bowl, a regular 100-Vatu bowl, or even a 200-Vatu bowl for a strong bit of kava at once.

Top photo: Central market, Port Vila
Bottom photo: A local kava bar
Photos ©2020 Chris Kilham





Kava *Piper methysticum*
Photo ©2020 Steven Foster



Pentecost Island coast
Photo ©2020 Chris Kilham

An innovation, if one can call it that, is the now-common practice of selling both kava and beer at *nakamals*. It is typical to enjoy one or two bowls of kava and follow that with a beer. The practice is called *kalé* and seems to be particularly enjoyed by tourists and expats.

Another major change in the Vanuatu kava trade concerns the VCMB, which for decades was the controlling authority for the kava trade. Since June 2019, the VCMB, which was made up of government bureaucrats, has been replaced by the more nimble Vanuatu Kava

Industry Association, members of which all work in the kava trade and better understand its operations, nuances, and needs.

Lastly, the government ban on exports of *tudei* or “two-day” kava has boosted the overall quality of Vanuatu kava exports. *Tudei* kava is especially high in dihydromethysticin and dihydrokavain, producing a powerful soporific effect and often causing headaches or dizziness. It is called *tudei* kava because its effects can persist for two days. Previously, many growers added *tudei* kava to their bags, and kava bars added *tudei* to their kava to produce a stronger experience, but with some potentially unpleasant effects. I have encountered *tudei* kava at some kava bars and have not enjoyed the effects at all. *Tudei* kava can be identified by testing kava root for flavokavains, which are not found in noble varieties of kava. The elimination of *tudei* kava from all exports ensures a better-quality kava with a better experience.

Pentecost Island

Much of my history in Vanuatu since 1995 has involved kava growers in several villages on the island of Pentecost, a long and narrow island north of *Éfaté* that is known for its traditional kava culture and high-quality kava, most notably *Borogu*,



Anabru market
Photo ©2020 Chris Kilham

which is a preferred variety for cultivation on that island. Thus, it was fortuitous that Michael Louzé acquires his kava from central and northern Pentecost, presenting an opportunity to get back to that area.

Michael has four agents on Pentecost, one of whom is Kasi Bebe on the east coast. I was eager to walk through the entire chain of trade for the kava that Michael acquires on Pentecost. To do that, we planned a trip to the island to meet with his agent Kasi and a team with whom we traveled.

We flew from Éfaté to the landing strip at Lonorore on the western coast of Pentecost Island. Lonorore is situated on a relatively calm and tranquil spot and has undergone significant improvements. The former bumpy grass strip is now a smooth asphalt runway, offering a nicer landing. We were met at Lonorore by Kasi, his sons Alexi and Bernard, a young man named Edmund, and another young man whose name I do not know. They were our companions and crew wherever we traveled on Pentecost.

During our days on Pentecost, we visited the eastern Pentecost villages of St. Henri, Laluk, and Lonfis. Laluk, the furthest north of the three villages, provides most of the kava sold by South Seas. Some kava is purchased and inspected at Lonfis, the village where Kasi and his family live. Some kava from central Pentecost gets stored in a clean kava storage building that Kasi maintains in St. Henri until it is eventually loaded onto one of the inter-island boats that ply the seas in that area. Inter-island traffic delivers goods such as rice, canned foods, beer, and hardware, and transports crops from outer islands to the capital.



All transport of kava around the eastern side of Pentecost is via boats, as no roads are on that side of the island. It is possible to walk from one village to another throughout the island on well-worn footpaths. Otherwise, any transport of cargo happens in fiberglass boats and larger inter-island vessels. Seas range from somewhat disagreeable to violent there, so hauling kava by boat involves hard work and danger. Yet, except during storms, kava traders are out in those waters.

At St. Henri, Lonfis, and Laluk, Michael and I spoke with chiefs and other people from the villages about the state of the kava trade and our hopes for the future. In each village, we drank kava in a traditional bamboo and palm nakamal where only men drink, unlike at the kava bars in Port Vila, where men and women drink together. The





Chopping kava roots
Photo ©2020 Chris Kilham

of hillsides and forms streams. After washing kava in clean spring water, the root is cut and dried in solar dryers.

Here are the steps kava undergoes when it is ready to harvest:

Digging out roots – Vanuatu growers used to wait until kava plants had matured for five years before harvesting the roots. However, analysis of kava roots shows that the kavalactone concentration in kava is optimal at three years' growth. Thus, many kava growers now harvest roots at three years. All digging of roots is performed with simple implements, like long wooden poles.

Cleaning roots – With its ample supply of fresh, clean water, central eastern Pentecost provides excellent conditions for cleaning kava roots. Here in a fresh stream, kava root is cleaned of all dirt before peeling the skin.

Root peeling – Peeling roots is typically performed with a machete. The Ni-Vanuatu learn to use bush knives from the time they are children. Their dexterous ability with blades aids them in quickly peeling the tough, fibrous roots of kava.

Chopping roots to drying size – After cleaning and peeling, roots are cut to a preferred size for drying. Every kava grower knows the ideal size to chop roots — not too thick or thin.

native people with whom we spent time very much want to see kava rise to greater market prominence. They are especially encouraged that many kava bars in the United States import Vanuatu kava. That is a source of great pride for the growers.

In Laluk, we started out in fields of Borogu kava, harvested root, and took it to a nearby stream for washing, peeling, and chopping. That area of Pentecost enjoys a strong supply of free-flowing spring water that bursts out

Kava in a solar dryer. Photo ©2020 Chris Kilham





Preparing a kava (*Piper methysticum*) drink
Photo ©2020 Chris Kilham

Drying roots – After cleaning, peeling, and chopping, kava roots are laid out in solar dryers, where they dry to about 12% moisture. Solar dryers make it possible to dry large quantities of kava and protect it from regular rains.

Pentecost Island Kava Trade

In the village of Lonfis, where Kasi and his family live, we saw kava arrive from growers in that area and in nearby villages. All the kava arrived clean, peeled, washed, and sun-dried. The kava was then weighed, and the growers were paid cash on the spot. This type of simple and immediate transaction is typical in the botanical trade worldwide. Even so, all the kava was then hand inspected, winnowing out any bad pieces. That kava would be stored until eventual shipment to Port Vila via inter-island cargo ships and undergo additional inspection, pressure washing, and sun-drying.

Back in Port Vila, when kava is ready to ship internationally, an inspector from Quarantine (Vanuatu Biosecurity) examines the kava for mold, fungus, rot, soil, and other unwanted material. Then, a sample is taken for testing for adulteration and pathogens at Vanuatu Biosecurity. Once a sample is approved, the shipper receives the documents required for export.

Vanuatu kava exporters use Virgin, Air New Zealand, Air Caledonia, and Air Vanuatu for shipping. Exporters no longer use independent shippers. Instead, they are making those arrangements themselves. This has changed since I started there in the 1990s. Half and whole containers of kava, weighing 10-20 metric tons, are shipped by sea instead.

In Port Vila, I met three scientists who help ensure the quality of Vanuatu kava: Vincent Lebot, PhD, who remains the most prominent kava researcher alive; Ruth Amos, who runs government kava testing; and Sylvie

Boulehouran, who heads up the Quarantine kava program. All three described to me their ongoing efforts to enhance testing of kava to maintain high-quality kava exports. Vincent is working with simple colorimetric tests to help assess types of kava, as well as high-performance thin-layer chromatography (HPTLC). Ruth is working on a possible expanded bacterial testing initiative. Sylvie is making sure that all kava samples undergo necessary scrutiny before receiving papers for export.

Calamity in Paradise

Days after I departed Vanuatu in February, COVID-19 so gripped the world that all shipping to and from Vanuatu ceased. All air traffic in and out of the country was halted, and regular passenger cruise ships stopped. The cessation of ingoing and outgoing traffic and tourists closed restaurants, hotels, resorts, and spas in Vanuatu, reduced traffic in kava bars, shuttered businesses, and halted kava exports. Only in May did some exports resume to New Caledonia. The economic damage of the pandemic has been acute for the tourism-dependent archipelago. That damage has reverberated throughout the entire kava chain of trade, slowing demand and reducing revenues.

At the beginning of April 2020, piling misery on top of COVID-19, Cyclone Harold, a Category 5 tropical cyclone hit Vanuatu, the Solomon Islands, Fiji, and Tonga, devastating many villages and destroying hundreds of thousands of kava plants. The villages Michael and I visited on Pentecost Island were hit badly, with homes and solar dryers destroyed. Growers have subsequently worked feverishly to get as much damaged kava out of the ground, cleaned, and dried to rescue some crop and income.

At present, the government of Vanuatu is allowing only the islands that were affected by Cyclone Harold to sell kava to Port Vila. The Minister of Climate Change, Bruno Leingkone, has assured all the people of Pentecost and other affected islands that they can put their kava on any cargo ships to be dropped at Port Vila without charge.

Michael Louzé described the scene after the cyclone hit (email, June 19, 2020):

The market is strange but going strong in a way. Before the cyclone, most exporters had big stock and had slowed down their purchases or stopped completely. After the cyclone, many believed that kava production will face a new shortage for the next three years (including myself to a certain

Chris Kilham and Vincent Lebot, PhD
Photo ©2020 Chris Kilham



extent), and many traders and exporters start to speculate. Farmers of course entertained this by saying it was their last harvest, and that after this, in one-month time there would be no kava for a long time.

The weather has been very good and sunny, ideal for sun drying, so with buyers willing to buy everything they could, farmers are selling as much as they can! Between you and me, I don't believe now that we will have a shortage. Many kava farms are untouched, lots of islands were not affected, and Pentecost was blessed by its many hills protecting many gardens.

[The] market in New Caledonia has resumed, slightly slower and tighter than before but still going strong ... but it is getting submerged with kava and should slow down in the weeks to come.

The USA, with the lockdown and logistics issues, had not been able to get kava for their nakamals so stocks were very low, and they are now ordering a lot ... the complete effect of [COVID-19] on the kava bar sector in the USA remains to be seen.

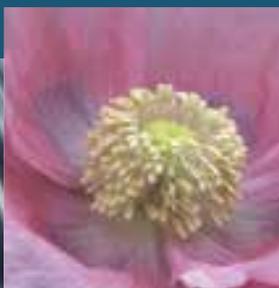
Conclusion

Vanuatu has a sustainable kava trade in which the plant is cultivated without any toxic agricultural inputs, the growers get a fair price, and market demand remains strong. The entire Vanuatu kava industry has become more sophisticated, with more measures to ensure high quality of exports and avoid contamination.

Both COVID-19 and Cyclone Harold have badly affected the Vanuatu kava trade, but this is a temporary situation. Kava from parts of Vanuatu that were not badly hit by Harold will fill a market void, and eventual lifting of shipping restrictions will allow for more export trade. Recovery will take time. Yet the people of Vanuatu remain remarkably resilient, and demand remains strong for kava, a stress-relieving agent that promotes peace and tranquility. HG

References

1. Fu PP, Xia Q, Guo L, Yu H, Chan PC. Toxicity of kava kava. *J Environ Sci Health C Environ Carcinog Ecotoxicol Rev.* 2008;26(1):89-112. Available at: www.ncbi.nlm.nih.gov/pmc/articles/PMC5868963/. Accessed June 25, 2020.
2. GDP (current US\$) – Vanuatu. The World Bank website. Available at: <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=VU>. Accessed June 25, 2020.
3. Pollock NJ. Sustainability of the kava trade. *Contemp Pac.* 2009;21(2):265-297. Available at: <https://scholarspace.manoa.hawaii.edu/bitstream/10125/18514/v21n2-265-297.pdf>. Accessed June 25, 2020.



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Unraveling the Voynich Codex by Jules Janick and Arthur O. Tucker. Cham, Switzerland: Springer; 2018. ISBN: 978-3-319-77293-6. Hardcover, 412 pages. \$54.99.

Flora of the Voynich Codex: An Exploration of Aztec Plants by Arthur O. Tucker and Jules Janick. Cham, Switzerland: Springer; 2019. ISBN: 978-3-030-19376-8. Hardcover, 353 pages. \$219.99.

By Steven Foster

A review of two recent books that present a detailed case for unraveling the origins and floristic genesis of the Voynich Codex is the type of book review that itself could become a book. *Unraveling the Voynich Codex* and *Flora of the Voynich Codex: An Exploration of Aztec Plants* were published in 2018 and 2019, respectively, and both were co-authored by Jules Janick, PhD, the James Troop Distinguished Professor of Horticulture at Purdue University, and the late Arthur O. Tucker, PhD (1945-2019), professor emeritus at Delaware State University.¹ The two texts add to the layers of mystery and controversy swirling around the authorship, origins, and content of what has been referred to as the world's most enigmatic manuscript: the Voynich Codex.

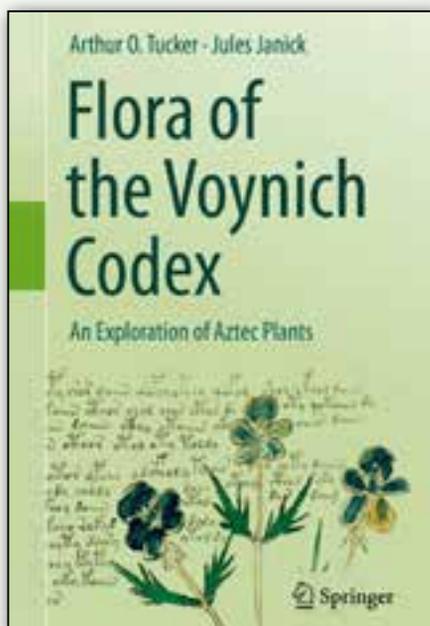
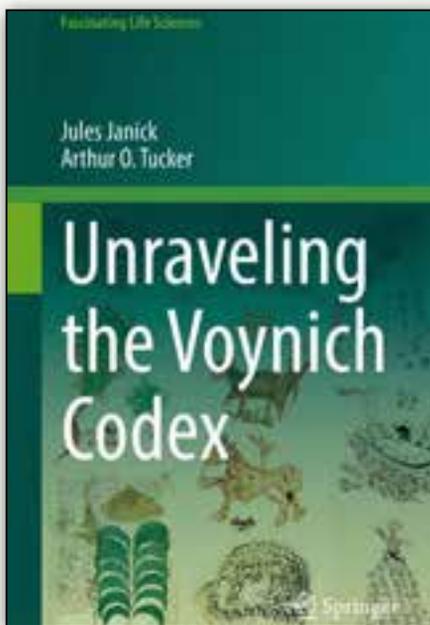
Polish-born antiquarian book dealer Wilfrid Voynich (1865-1930) purchased the codex that bears his name in a lot of manuscripts from a Jesuit order in 1912. He understood the uniqueness of the manuscript and held onto it until his death in 1930, unable to obtain his asking price of \$100,000. He bequeathed it to his wife, Ethel Voynich, and when she died in 1960, Anne Nill, a longtime Voynich associate in the antiquarian book business, inherited the manuscript. She sold it to famed antiquarian book dealer, H.P. Kraus (1907-1988) in 1961 for \$24,500. Kraus offered it for \$160,000, but with no takers, he donated it to the Beinecke Rare Book and Manuscript Library at Yale University in 1969, where today the work known as “Beinecke MS 408” has a permanent home. A full-size reproduction, including the foldout folios, was published in 2016 by Yale University Press, with accompanying interpretive chapters by various specialists.²

Unraveling the Voynich Codex

In the foreword of *Unraveling the Voynich Codex*, the authors explain that Tucker became interested in the Voynich Codex in June 2012 while studying Latin American herbs and 16th-century codices from New Spain. He observed incorrect plant species identifications by non-botanists in several works pertaining to the manuscript. This led to a collaboration between Tucker and herb expert and former NASA information technologist Rexford H. Talbert in which they identified 37 plants, seven animals, and the mineral boleite, all of which are of Mesoamerican origin. Their original, peer-reviewed article, “A Preliminary Analysis of the Botany, Zoology, and Mineralogy of the Voynich Manuscript,” was published in *HerbalGram*'s 100th issue in 2013.³ The article “proved a revelation to Janick, who had minor contact with the Voynich Codex” up until that time.⁴ The collaboration between Janick and Tucker resulted in further plant and animal identifications, and speculative-though-plausible assumptions led them to hypothesize that the Voynich Codex is of 16th-century origin from New Spain, and, ultimately, to the publication of the two books reviewed here.

Unraveling the Voynich Codex lays the foundation for the hypothesis that the codex was created after the European colonization of the American continents, based on hard evidence of plant, animal, and mineral identifications and the previous work of other “Voynichologists.” According to Tucker and Janick, the botanical illustrations, in their crude, two-dimensional depictions, show plants native to the Americas and are comparable in style to those found in the Badianus Manuscript from 1552, titled *Libellus de Medicinalibus Indorum Herbis* (“Little Book of the Medicinal Herbs of the Indians”; see *HerbalGram* issue 27⁵). Tucker and Janick admit that their assertions are speculative and that they lack academic expertise in linguistics and astronomy, yet believe that their postulations are plausible.

The 412-page *Unraveling the Voynich Codex* is divided into four parts. Part I (chapters 1-3) introduces the reader to the Voynich Codex and its origins and provides a possible historical context for the codex in



Aztec Mexico and Catholic Spain. Part II (chapters 4-10) lays the groundwork for the authors' case that the work is of Mesoamerican origins, including analyses of the plant and mineral iconography, identification of animals, and other more speculative stretches of the imagination in map interpretation, astrological illustrations, and other details. In a paper published in 1944, taxonomist Hugh O'Neill identified sunflower (*Helianthus annuus*, Asteraceae) and a capsicum pepper (*Capsicum* sp., Solanaceae) among the 359 plant images or "polymorphs" in the codex.⁶ Tucker and Talbert's 2013 *HerbalGram* article identified 37 plant species,³ and a 2016 paper by Tucker and Janick extended the list to 58 identified polymorphs.⁷ In Part II, they identify two more plants from the Mesoamerican flora.

Part III (chapters 11-13) is a wide-ranging discussion on the topic of "decipherment" with explanations of cryptological analyses, decoding symbols, Mesoamerican languages, and relationships to the cryptic symbols of the Voynich Codex. Decoding the codex remains elusive, but the authors lay out a foundation for understanding the progress, prospects, and problems related to decipherment.

Part IV (chapters 14-16), "The Author and the Artist," provides the authors' hypothesis, theories, and evidence pointing to the real possibility that the codex author(s) and artist(s) were post-conquest members of the Aztec nobility, who were trained by Franciscan friars. The Catholic Church created several schools, which trained the sons of *caciques* (chiefs) from towns close to modern-day Mexico City. The Spanish ruler Charles I (ruling from 1516 to 1556) funded the convent schools where the training took place. The Badianus Manuscript was one product of these institutions. The aim of this section of the book is to "discover if the multifaceted aspects of the [Voynich] manuscript were compatible with the time, place, and history associated with 16th-century New Spain." In Chapter 14, the authors posit that whoever created the Voynich was a native Mexican polymath with wide interests and many talents.

In Chapter 15, they recount the many claims put forth by various scholars and speculators about the authorship of the Voynich Codex, including Roger Bacon (ca. 1214-ca. 1294), Antonio Averlino (1400-1469), Leonardo da Vinci (1452-1519), Nostradamus (1503-1566), Francisco Hernández de Toledo (1514-

The stuck-in-medieval-Europe Voynichologists, bloggers, and theorists love to hate the work of Tucker and colleagues, and, in particular, the two works reviewed here, which present the most comprehensive biology-based investigations of the Voynich to date.

1587), John Dee (1527-1608), and Edward Kelley (1555-1597), to name a few! They also provide detailed evidence of the identity of the illustrator.

Chapter 16 summarizes Tucker and Janick's "Conclusions, Conjectures, and Future Studies." They are convinced that the Voynich Codex is a Mesoamerican manuscript based on botanical and zoological identification of plants and animals. They convincingly conclude that the depictions of the sunflower and armadillo disprove the assertion that the Voynich Codex is a 15th-century European manuscript.

Flora of the Voynich Codex

The American Botanical Council's 2019 James A. Duke Excellence in Botanical Literature Award was given to

Flora of the Voynich Codex: An Exploration of Aztec Plants. *Flora* advances the concept that O'Neill's identification of two Mesoamerican species, sunflower and capsicum pepper, in the Voynich Codex clearly indicates that it is a post-Columbus manuscript. The authors note that this assertion counter-weighs the universally accepted dogma among Voynich scholars and conspiracy theorists that the Voynich Codex is of 15th-century European origin. The authors imply that non-botanist scholars ignore, discount, or explain away the botanical evidence evoked by the two-dimensional botanical illustrations in the work.

Illustration from the Voynich Ms. (fol. 23v). Image courtesy of Beinecke Rare Book and Manuscript Library, Yale University



In three previous works, Tucker and colleagues had identified 60 species of phytomorphs in the Voynich Codex. In *Flora*, the number of species with putative identifications increases to 169, with 131 plant images identified from the Voynich Codex herbal section and 41 plants from the pharmaceutical section of the book. Chapter 4 discusses their identification and makes up the bulk of the book (pages 39-220), and Chapter 5 provides an analysis of the botanical findings. The identifications in Chapter 4 include photographic images of the purported associated plant species which show, where appropriate, the live plant, herbarium sheets, botanical illustrations, or comparable 16th-century images. Each entry includes a description with the botanical name and identification; plant distribution; English, Spanish, and, if known, Mesoamerican names; and notes on uses of the plants, including medicinal, culinary, and others. If appropriate, the authors include information about related species. Some plants are identified at the genus level. If the species is questionable, a question mark is inserted in parentheses, and if likely but unconfirmed, they use the abbreviation “cf.” to indicate “compares favorably.”

The authors consulted limited literature regarding medicinal uses of the plants described. For example, for hand fern (*Ophioglossum palmatum*, Ophioglossaceae), further exploration of the medicinal plant literature would have shown numerous historical uses for the genus. Various *Philodendron* (Araceae) species have been associated with fish poisons, curare mixtures (paralyzing agents often used to coat poison arrows), and contraceptives in works edited by Richard E. Schultes, PhD (1915-2001), yet the authors write: “Uses: unknown.” The “uses” section is often the weakest point in the individual species entries but opens the door to further explore more wide-ranging medicinal plant literature.

Conclusion

The internet is rife with bloggers and self-proclaimed Voynich experts who, despite scientific evidence to the contrary, continue to hold on to their fanatical beliefs and assertions while leveling persistent attacks on the premise of Tucker and Talbert³ and the two books by Tucker and Janick. All one must do is search “Voynich” to begin the journey down the divergent roads of skepticism, prejudice, and

speculation. For some, it is a fulltime pursuit. The stuck-in-medieval-Europe Voynichologists, bloggers, and theorists love to hate the work of Tucker and colleagues, and, in particular, the two works reviewed here, which present the most comprehensive biology-based investigations of the Voynich to date.

Since its discovery in the early 20th century, the Voynich Codex has been analyzed by religious historians, Roger Bacon specialists, early European history experts, conspiracy theorists, space alien devotees, and the hopelessly obsessed. Along with ancillary convincing evidence, Tucker and Janick associate the time period of the manuscript’s creation to post-Spanish conquest of the Aztecs. Clarity of time, place, and subject matter provide the foundational scholarship for further research, and the eventual decryption of the text. These books will serve as a lasting legacy for Tucker and Janick, perhaps equal to that of the Voynich Codex itself. HG

Steven Foster is an author, photographer, and herbalist who serves on the ABC Board of Trustees.

References

1. Bauman H. Arthur Oliver Tucker III: 1945-2019. *HerbalGram*. 2019;123:78. Available at: <http://cms.herbalgram.org/herbalgram/issue123/hg123-oblit-tucker.html>. Accessed July 21, 2020.
2. Clemens R, ed. *The Voynich Manuscript*. New Haven, CT: Yale University Press; 2016.
3. Tucker A, Talbert R. A preliminary analysis of the botany, zoology and mineralogy of the Voynich Manuscript. *HerbalGram*. 2013;100:70-75. Available at: <http://cms.herbalgram.org/herbalgram/issue100/HG100-voynich-online.pdf>. Accessed July 21, 2020.
4. Janick J, Tucker AO. *Unraveling the Voynich Codex*. Cham, Switzerland: Springer; 2018.
5. Foster S. The Badianus Manuscript: The first herbal from the Americas. *HerbalGram*. 1994;27:112-117. Available at: <http://cms.herbalgram.org/herbalgram/issue27/article306.html>. Accessed July 21, 2020.
6. O’Neill H. Botanical observations on the Voynich MS. *Speculum*. 1944;19(1):126-128.
7. Tucker AO, Janick J. Identification of phytomorphs in the *Voynich Codex*. *Hort Rev*. 2016;44:1-64.

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Anthony John ‘Tony’ Hayes 1955 – 2020

By Hannah Bauman

Tony Hayes, founder and president of Ridge Runner Trading Company (RRTC) in Boone, North Carolina, died unexpectedly on July 2, 2020, at age 65. Hayes was an expert in Appalachian herbs of commerce and was involved with the trade of native American wildcrafted botanical materials for nearly 50 years.

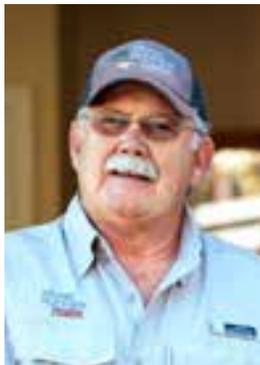
Born in Wilkes County, North Carolina, on February 2, 1955, Hayes was raised with a deep interest in and respect for the flora of his native Appalachia. He began working in 1973, still a teenager, as an herb buyer for Arthur Lowe Fur and Herb Company in North Wilkesboro. In 1981, he began working in a similar capacity for Wilcox Drug Company and then, in 2000, he formed RRTC with his wife, Sandra Miller Hayes. The “ridge runner” in the company’s name is a nickname for people who live at the higher altitudes of the southeastern United States, particularly in the Appalachian Mountains. Throughout his life and career, Hayes sought to aid and elevate his birthplace.

American ginseng (*Panax quinquefolius*, Araliaceae) is one of the most valuable wildcrafted plants in the region, and Hayes was an expert in the subtle regional differences in the roots and leaves as items of commerce. He was also highly knowledgeable about the culture surrounding its harvest and the historical significance of medicinal plants in the United States. Just before his death, Hayes was proud to be interviewed as part of the Smithsonian Institution’s Folklife Festival. He discussed ginseng harvesting and his perspective on the role and responsibility he had as a ginseng dealer to educate harvesters and the public, particularly regarding sustainability. Segments of the interview were featured in a webinar that aired on July 16, 2020, just two weeks after he died.¹

“The ethnobotany around [ginseng] would be far more valuable to us all than how much it’s worth,” Hayes said in the video.

According to Edward Fletcher, president of raw material supplier Native Botanicals, Inc. and an expert on native American medicinal plants, Hayes never sought to hoard or gatekeep his encyclopedic knowledge and experience. “Tony Hayes was a walking pharmacopeia of botanical knowledge on the medicinal plants that we use in our industry,” Fletcher wrote (email, September 24, 2020). “He was always willing to talk about and share that knowledge, and it was easy for him to do so with both wildcrafters and vice presidents of large companies due to his welcoming and comforting demeanor. Tony’s expertise on American ginseng was unsurpassed. He mentored me throughout our years together, and my life as well as countless others have been changed forever because of him.”

Throughout his career, Hayes assumed leadership roles in the herbal products industry, such as serving as co-chair of the American Herbal Products Association’s (AHPA’s) Non-Timber Forest Products subcommittee. Under the auspices



of RRTC, he also financially supported many research projects through the AHPA Foundation for Education and Research on Botanicals (AHPA-ERB Foundation).

AHPA President Michael McGuffin valued Hayes’ contributions to AHPA initiatives. “[Tony had] for many years been the first on my list of contacts whenever I needed a better understanding of the collection practices and harvest data on wild Appalachian plants,” he wrote (email, October 1, 2020). “At the same time, I know Tony was still committed to learning more about his craft, and the last time I met with him late in 2019,

he and his son Josh were preparing to transplant woods-grown goldenseal [*Hydrastis canadensis*, Ranunculaceae] to support industry interest in cultivated sources of this important herb. He was first and foremost my friend, and I will miss him.”

Hayes is remembered as a friendly, caring man who always sought to help others. He loved being outdoors, which, combined with his love of geography, made him a local expert on his region of North Carolina. He also enjoyed cooking, especially grilling, and playing music, particularly the drums.

Chuck Wanzer, founder of North Carolina-based Botanicals, Inc., worked with Hayes for 18 years at Wilcox Drug Company and fondly remembers his friend’s knowledge of the great outdoors. “He instructed me about ginseng and other botanicals as well as fur, which we both enjoyed,” Wanzer wrote (email, September 26, 2020). “He was a true friend. We were friendly competitors after the Wilcox Drug Company shut down and we went our separate ways.... He will be missed for sure, as there was only one Tony Hayes.”

RRTC will continue under the leadership of Hayes’ wife, son Joshua, and daughter Cassandra. Hayes discusses what would happen to his company after his death in the Smithsonian video.

“It’ll be up to [Cassandra] whether she and her brothers — whether this continues or not,” he said. “It’s set up for it to go on. If something happens to me, we’re not going to be fire-selling anything and shutting down.”

Tony Hayes is survived by Sandy, his wife of 39 years; children Christopher Hayes, Joshua Hayes, and Cassandra Hayes (Matthew) Vincent; five grandchildren; brother Richard Hayes; brother-in-law Eric Brown; stepmother Ila Dean Hayes; and stepsiblings Sandy Sheppard, Daniel (Kristy) Vickers, Missy (Sam) Mayberry, and Robert Vickers. He was preceded in death by his parents, John Hayes and Ena Murrell Hayes, sisters Tina Hayes and Heather Brown, and stepbrother Christopher Church. HG

Reference

1. Story Circle: Dealer’s Choice — The Role of Dealers in Ginseng Conservation. Smithsonian Center for Folklife and Cultural Heritage website. July 16, 2020. Available at: <https://festival.si.edu/event/story-circle-dealer-s-choice-the-role-of-dealers-in-ginseng-conservation>. Accessed September 24, 2020.

Cyrus Thomas Hyde

1930 – 2020

By Hannah Bauman

Cyrus Hyde, owner and operator of Well-Sweep Herb Farm in Port Murray, New Jersey, died at home on June 19, 2020, at the age of 90. Hyde was an experienced horticulturist and educator who transformed four acres of run-down land into a 120-acre farm that grows and sells unusual and boutique varieties of herbs, many of which were hybridized by Hyde himself.

Hyde was born on April 5, 1930, in Totowa, New Jersey. He grew up learning the lore of herbs from his family and began his career as a horticulturist when he worked in the herb gardens at Waterloo Village Historic Site, part of Allamuchy Mountain State Park in Stanhope, New Jersey. In 1969, Hyde and his wife, Louise, purchased the initial four acres of Well-Sweep.

Hyde transformed the poor, rocky soil of the site using organic and sustainable methods, and soon, Well-Sweep became a self-sustaining farm with a greenhouse, drying barn, and livestock. Using his creative eye and the colorful variegated herb varieties that he grew, Hyde designed elaborate display gardens. In addition to plants, Hyde also bred long-tailed onagadori and Phoenix chickens.

“When I visited Well-Sweep Herb Farm in 1980, the herb gardens created by Cyrus Hyde were some of the most beautiful in the country at that time, including a charming knot garden [a garden of aromatic plants with an intricate design] and well-maintained herb beds,” wrote Holly Shimizu, executive director emeritus of the US Botanic Garden (email, October 1, 2020). “As I was developing plant collections for the National Herb Garden at the US National Arboretum in the 1980s, Well-Sweep Herb Farm was an essential source for many of the otherwise unavailable herbs. Cyrus Hyde was masterful at growing and propagating herbs and spices from all over the world.”

According to the company’s website, Well-Sweep currently is home to one of the largest collections of herbs and perennials in the United States, with 104 new varieties added in 2019 that brought the total up to almost 1,900 different varieties. Following Hyde’s vision, the farm is completely organic and provides not only plants for sale around the country but also educational lectures, classes, and events. Hyde was a sought-after lecturer and was happy to spread his knowledge and experience to garden groups, schools, conventions, botanical gardens, and visitors at Well-Sweep.



In 1991, Hyde received the Nancy Putnam Howard Award for Excellence in Horticulture from the Herb Society of America and in 2008 he presented the Otto Richter Memorial Lecture for the International Herb Association. Hyde also gave the 10th annual Audrey Harkness O’Connor Lecture at Cornell University in 1998. In addition, he gave talks at James Madison University, the New York Botanical Garden, the Minnesota Arboretum, and more.

Hyde is remembered by his family and friends as a man who loved people. “He was a collector of people,” according to a post on Well-Sweep’s Facebook page on the day of his death.¹ “[He was] so interested in different nationalities and cultures and countries, he made so many friends over the years.” He enjoyed meeting and learning from people from all walks of life. He also had a passion for food and cooking, which was an extension of his love of herbs.

The farm will remain in operation under the leadership of his wife Louise, son David, and grandchildren. Cyrus Hyde is survived by Louise, his wife of 60 years; children David (Maria) Hyde, Holly (Thomas) McDuffee, and Mark (Gwen) Hyde; and grandchildren Patrick McDuffee, Melissa (Tyler) Passarelli, Daniel McDuffee, Sarah Hyde, and Jason Hyde. He is predeceased by his parents, James J. and Alida Jane Hyde (née Berdan), and siblings Margaret Donato, William Hyde, and John Hyde. HG

Reference

1. Well-Sweep Herb Farm. Facebook.com. June 19, 2020. Available at: www.facebook.com/WellSweepHerbFarm/posts/4505725276120352?__tn__=-R. Accessed September 30, 2020.



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Dietary Fiber	10.2 g	34% DV

Very good source of

Vitamin B ₆	0.33 mg	19.4% DV
Vitamin A	870 IU	17.4% DV
Iron	2.32 mg	12.9% DV

Good source of

Potassium	406 mg	8.6% DV
Thiamin (B ₁)	0.1 mg	8.3% DV
Riboflavin (B ₂)	0.09 mg	6.9% DV

Phytochemical Focus

- Elderberries are an excellent source of flavonoids, which can provide protection against oxidative stress.
- The dark color of elderberries is attributed primarily to the presence of anthocyanins, which are associated with antiviral and immune-stimulating effects.

Fast Facts

- The medicinal use of the elder shrub dates back to Europe in the fifth century BCE.
- Historically, the leaves, bark, flowers, and fruits of black elder all were used for their medicinal properties, but clinical research has focused mainly on the fruit (berries).
- Evidence for the traditional medicinal uses of elderberry for treating colds, constipation, hypertension, and edema has been documented in scientific literature.
- Black elderberry consistently has demonstrated antiviral and antioxidant activities in both experimental and clinical studies.



Elderberry *Sambucus nigra*
Photo ©2020 Steven Foster

About ABC's Food as Medicine Series

Every other month, the American Botanical Council's monthly e-newsletter HerbalEGram highlights a conventional food and explores its history, traditional uses, nutritional profile, and modern medicinal research. The articles, written by ABC Education Coordinator Jenny Perez, also feature a nutritious recipe to encourage readers to experience the extensive benefits of these whole foods.

The full “Food as Medicine: Black Elderberry” article with references is available on ABC's website in the HerbalEGram section (February 2020 issue).

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References:

¹ Riva A. et al Eur J Drug Metab Pharmacokinet. 2018 Oct 16. doi: 10.1007/s13318-018-0517-3.

² Cesarone, M. R., et al. Minerva medica (2019).

³ Manuscript submitted.

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