

Adulteration: Context, history and responsibility

IADSA Botanical Roundtable

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Adulteration in context: Foods



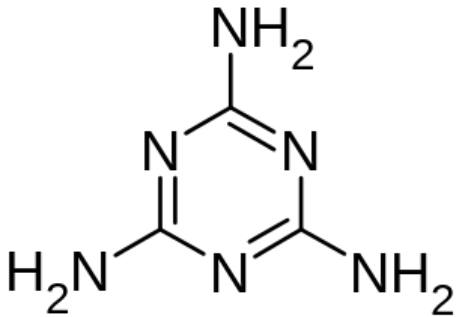
INTERPOL

"Today's rising food prices and the global nature of the food chain offer the opportunity for criminals to sell counterfeit and substandard food in a multi-billion criminal industry which can pose serious potential health risks to unsuspecting customers."

30 March 2016 Largest-ever seizures of fake food and drink in INTERPOL-Europol operation

- **10,000 tons + 1 million liters of counterfeit and substandard food seized in 57 countries**
 - Italy: 85 tons of olives 'painted' with copper sulfate to enhance color
 - Australia: 450 kg of blended or adulterated honey
 - Australia: Peanuts repackaged and relabeled as pine nuts
 - South Korea: Weight loss products labeled as "natural" but containing an undeclared prescription drug
 - Bolivia: Thousands of cans of sardines with fake labels of a famous Peruvian brand
 - Hungary, Italy, Lithuania and Romania: Counterfeit chocolates, sweets and non-alcoholic sparkling wine
 - UK, Greece, Burundi, Zambia: Fake labels of wine and other alcoholic beverages

Adulteration in context: Foods



NOTE: In 2007, melamine spiking of wheat gluten from China used in pet foods was associated with the deaths of 100s of cats and dogs in the U.S.; a similar incident may have occurred in Korea and Taiwan in 2004.

9 September 2008 AEs associated with melamine in infant formula first reported (*Shanghai Daily*)

- Kidney and urinary tract AEs affected about 300,000 Chinese infants and young children; 6 deaths reported
- Melamine found to be added to diluted milk to increase nitrogen levels and protein analysis
- 22 Chinese infant formula makers' products (including Sanlu Group) found to contain melamine
- Melamine-laced milk ingredients exported from China to at least 47 countries; later found in many finished products with milk ingredients (candy, cookies, etc.)

Adulteration in context: Drugs



"It's a sad and cruel fact that drug and device counterfeiting and adulteration pose serious threats to public health."

- **16 April 2015** Counterfeit Botox found in U.S.; distributed by an unlicensed supplier, possibly nationwide
- **21 January 2015** Counterfeit Cialis found entering U.S.; mailed to a single individual
- **5 February 2015** Counterfeit cancer drug (bevacizumab) found in U.S. containing none of the drug; sold by unlicensed wholesaler; FDA informed almost 800 doctors
- **29 May 2012** Warning issued to consumers and healthcare professionals re: counterfeit Adderall in which analysis showed actual APIs absent; sold on Internet
- **14 February 2012** Counterfeit Avastin (cancer drug bevacizumab) found in U.S. containing none of the drug; sold by unlicensed distributor
- **1 January 2007-31 May 2008** Acute reactions and as many as 179 deaths (U.S. alone) in dialysis patients receiving heparin injections; found to be contaminated with synthetic over-sulfated chondroitin sulfate; "intentionally contaminated ... to reduce the cost."

...not a new problem

Robert Fortune. *Two visits to the tea countries of China and the British Tea Plantations in the Himalaya* (1853)

As many persons in Europe and in America have a peculiar taste for coloured green teas, I will now give a “full and particular account” of the colouring process as practiced in the Hwuy-chow green-tea country upon those teas which are destined for the foreign market...:

“The superintendent of the workmen managed the colouring part of the process himself. Having procured a portion of Prussian blue, he threw it into a porcelain bowl, not unlike a chemist's mortar, and crushed it into a very fine powder. At the same time a quantity of gypsum was produced and burned in the charcoal fires which were then roasting the teas. The object of this was to soften it in order that it might be readily pounded into a very fine powder, in the same manner as the Prussian blue had been. The gypsum, having been taken out of the fire after a certain time had elapsed, readily crumbled down and was reduced to powder in the mortar. These two substances, having been thus prepared, were then mixed together in the proportion of four parts of gypsum to three parts of Prussian blue and formed a light-blue powder, which was then ready for use.

...not a new problem

Robert Fortune. *Two visits to the tea countries of China and the British Tea Plantations in the Himalaya* (1853)

“This colouring matter was applied to the teas during the last process of roasting. About five minutes before the tea was removed from the pans—the time being regulated by the burning of a joss-stick—the superintendent took a small porcelain spoon, and with it he scattered a portion of the colouring matter over the leaves in each pan. The workmen then turned the leaves rapidly round with both hands, in order that the colour might be equally diffused.

...“It seems perfectly ridiculous that a civilised people should prefer these dyed teas to those of a natural green. No wonder that the Chinese consider the natives of the west to be a race of ‘barbarians.’

...not a new problem

Robert Fortune. *Two visits to the tea countries of China and the British Tea Plantations in the Himalaya* (1853)

“One day an English gentleman in Shanghae, being in conversation with some Chinese from the green-tea country, asked them what reasons they had for dyeing the tea, and whether it would not be better without undergoing this process. They acknowledged that tea was much better when prepared without having any such ingredients mixed with it, and that they never drank dyed teas themselves, but justly remarked that, as foreigners seemed to prefer having a mixture of Prussian blue and gypsum with their tea, to make it look uniform and pretty, and as these ingredients are cheap enough, the Chinese had no objection to supply them, especially as such teas always fetched a higher price!

Drug-spiking: An international issue

- ❑ **Products “...masquerading as” dietary supplements (Michael Levy, FDA)**
- ❑ **Main product categories:**
 - ❑ **Male enhancement (sildenafil and analogs)**
 - ❑ **Weight-loss (sibutramine; diuretics; laxatives)**
 - ❑ **Athletic performance (steroids)**
- ❑ **International in scope: Australia, Austria, Canada, China, Denmark, Ireland, Israel, Italy, Malaysia, Mexico, Singapore, Switzerland, UK**
- ❑ **Three criminal actions in U.S. in 2015**

KEEP SUPPLEMENTS CLEAN.ORG

Key Product Categories ▾

Info for Consumers

Info for Industry

International Enforcement

FDA enforces against tainted products masquerading as supplements

Products that contain vitamins, minerals, herbs and other health-promoting ingredients are sold in countries all over the world. These products may be marketed as a category of food, as is the case with dietary supplements in the U.S., or in a drug category, such as the natural health products sold in Canada. These products are sold in full compliance with the legal and regulatory statutes in effect in various countries around the world.

The vast majority of dietary supplement products fully comply with applicable laws and are properly sold to consumers. However, some unscrupulous companies have threatened consumer confidence by selling tainted products that contain undeclared prescription drugs and other chemicals. Since 2008, FDA has identified nearly 400 such products. These unlawful ingredients have been found in capsules, tablets, powders, teas, and coffees. While these tainted products represent a tiny minority of all dietary supplements sold, it is important that consumers have confidence when buying their products from reputable companies.

The U.S. Food and Drug Administration called attention to this problem with the following statement:

FDA has identified an emerging trend where over-the-counter products, frequently represented as dietary supplements, contain hidden active ingredients that could be harmful. Consumers may unknowingly take products laced with varying quantities of approved prescription drug ingredients, controlled substances, and untested and unstudied pharmaceutically active ingredients. These deceptive products can harm you!

The American Herbal Products Association (AHPA) has created this website to keep the dietary supplement industry informed on issues related to illegal tainted products being sold as “dietary supplements”.

What responsible supplement companies need to know

On December 15, 2010, FDA announced that it is working with U.S. trade associations, including AHPA, to make sure that supplement companies comply with the law. FDA also issued a [letter to industry](#) that addresses roles and responsibilities of companies to ensure that their products do not contain undeclared ingredients that would cause them to be adulterated. More specifically, FDA's letter:

- Reminds dietary supplement companies of their obligation under current good manufacturing practice (cGMP) to establish and meet specifications on those types of contamination that may adulterate or lead to adulteration of the finished batch of dietary supplement (see 21 CFR 111.70(b) and 111.75(a)).

- Notes that a strong program of quality



— THE UNITED STATES —
DEPARTMENT of JUSTICE
U.S. Attorney's Office

Western District of North Carolina

FOR IMMEDIATE RELEASE

Wednesday, April 1, 2015

Maker of Erectile Dysfunction Products Sentenced To Nine Years In Prison For Misbranding And Selling Drugs As "All-natural" Herbal Supplements

The Products Contained Pharmaceutical Compounds Smuggled from China

CHARLOTTE, N.C. – Kamraz Rezapour, 53, formerly of Creston, N.C. was sentenced today to 108 months in prison for defrauding consumers of nearly \$5 million by misbranding erectile dysfunction drugs and selling them as “all natural” herbal supplements, announced Jill Westmoreland Rose, Acting U.S. Attorney for the Western District of North Carolina. Chief U.S. District Judge Frank D. Whitney also sentenced Rezapour to three years of supervised release and ordered the defendant to pay a \$15,000 fine and \$44,100.52 in restitution. The Court also ordered the forfeiture of the proceeds of Rezapour’s crimes, including over \$1.5 million in seized funds, gold and silver coins, along with a condominium located in Tampa, Florida.



FOR IMMEDIATE RELEASE

Monday, October 19, 2015

Owner of Pennsylvania Diet Supplement Business Sentenced to 30 Months Imprisonment for Selling Misbranded Drugs as Weight Loss Products over the Internet

The U.S. Attorney's Office of the Middle District of Pennsylvania announced today that Cheryl Floyd, age 52, of Harrisburg, Pennsylvania, owner of Floyd Nutrition LLC, was sentenced to 30 months in federal prison by U.S. District Court Judge Sylvia H. Rambo of the Middle District of Pennsylvania today in Harrisburg for introducing misbranded drugs into interstate commerce and money laundering. Judge Rambo also ordered Floyd to pay \$10,000 in fines and \$7,530 in restitution.

According to summaries presented to the court by Assistant U.S. Attorney Christy H. Fawcett of the Middle District of Pennsylvania in connection with the guilty plea and the sentencing hearing, Floyd, also known as Cheryl Floyd Brown, was the owner and operator of an internet-based business known as Floyd Nutrition LLC, based at her Harrisburg residence and with warehouse facilities in the Harrisburg area.

The items offered for sale between 2010 and 2014 were purported all-natural dietary supplements sold as weight loss products. They contained the drugs sibutramine and phenolphthalein which are not listed as ingredients in the product labels.

Ingredient adulteration

- ❑ ***Digitalis lanata* leaf as unintentional substitute for plantain leaf; one EU import widely distributed in U.S. in 1997**
- ❑ ***Parthenium integrifolium* root as substitute for *Echinacea purpurea* due to common name confusion (both called “Missouri snakeroot”); not an issue with cultivated sources**
- ❑ **Various materials as substitutes for *Hoodia gordonii*; all imports in powder form; market spike has passed**
- ❑ **Triclosan (and other synthetic microbicides) labeled as “grapefruit seed extract”**
- ❑ ***Ginkgo biloba* leaf extract w/added rutin or *Sophora japonica* fruit; deliberate substitution to affect chemical analysis**
- ❑ **Bilberry fruit extract w/ added synthetic amaranth (red) dye; deliberate addition to affect spectrophotometric assay**
- ❑ **Etc.; all above and others are posted on AHPA’s website and generally well known to responsible manufacturers**

Tools for responsible industry

- **Regulatory compliance**
 - **U.S. FDA cGMP for dietary supplements (21 CFR 111) is modeled after food and drug cGMP**
 - **Requires “at least one test or examination” to verify identity of every ingredient**
 - **Also requires specifications to limit “those types of contamination that may adulterate” a finished product**
- **Additional resources**
 - **Many professional contract analytical labs**
 - **AOAC / Method validation**
 - **AHPA Botanical Identity References Compendium**
(<http://www.botanicalauthentication.org/>)

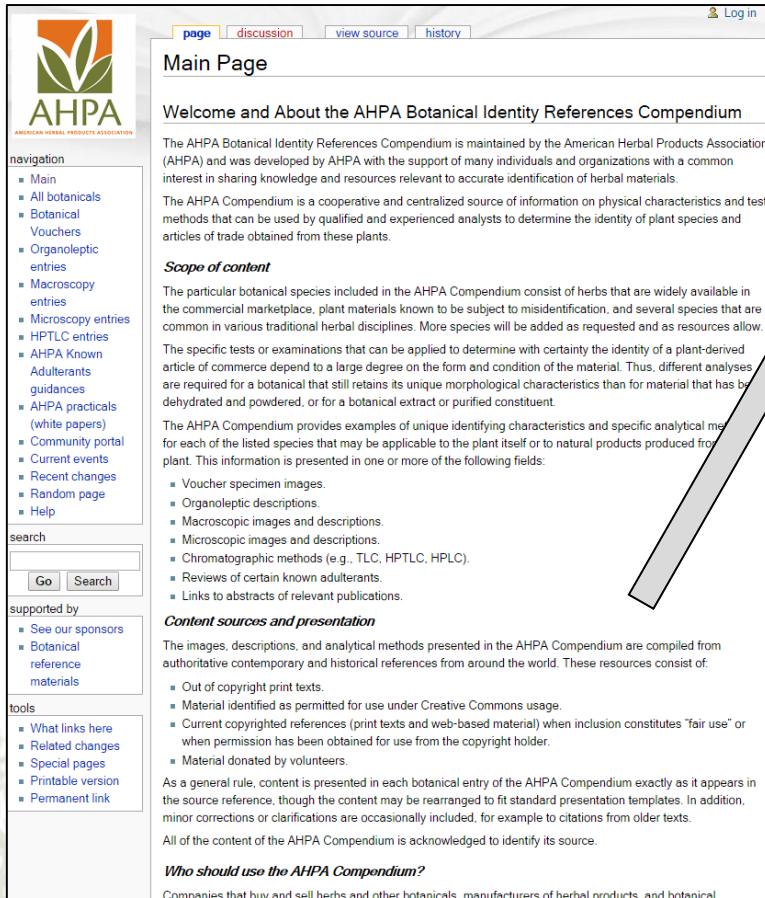
The AHPA Compendium

- > 190 species
 - Nomenclature
 - Voucher specimens
 - Organoleptic characteristics
 - Macroscopic characteristics
 - Microscopic characteristics
 - HPTLC methods and images
 - Other chromatographic methods
 - Newly including DNA sequencing
 - AHPA known adulterants
 - Literature references



The screenshot shows the AHPA Botanical Compendium website. At the top left is the AHPA logo. Below it is a navigation menu with the following items: Main, All botanicals, Botanical Vouchers, Organoleptic entries, Macroscopy entries, Microscopy entries, HPLC entries, HPTLC entries, DNA entries, AHPA Known Adulterants guidances, AHPA practicals (white papers), Community portal, Current events, Recent changes, Random page, and Help. To the right of the navigation menu is a toolbar with buttons for page, discussion, edit, history, delete, and move. The main content area is titled "Main Page" and contains a welcome message and a section titled "Scope of content" which lists the types of materials included in the compendium: Voucher specimen images, Organoleptic descriptions, Macroscopic images and descriptions, and Microscopic images and descriptions.

The AHPA Compendium



page discussion view source history Log in

Main Page

Welcome and About the AHPA Botanical Identity References Compendium

The AHPA Botanical Identity References Compendium is maintained by the American Herbal Products Association (AHPA) and was developed by AHPA with the support of many individuals and organizations with a common interest in sharing knowledge and resources relevant to accurate identification of herbal materials.

The AHPA Compendium is a cooperative and centralized source of information on physical characteristics and test methods that can be used by qualified and experienced analysts to determine the identity of plant species and articles of trade obtained from these plants.

Scope of content

The particular botanical species included in the AHPA Compendium consist of herbs that are widely available in the commercial marketplace, plant materials known to be subject to misidentification, and several species that are common in various traditional herbal disciplines. More species will be added as requested and as resources allow.

The specific tests or examinations that can be applied to determine with certainty the identity of a plant-derived article of commerce depend to a large degree on the form and condition of the material. Thus, different analyses are required for a botanical that still retains its unique morphological characteristics than for material that has been dehydrated and powdered, or for a botanical extract or purified constituent.

The AHPA Compendium provides examples of unique identifying characteristics and specific analytical methods for each of the listed species that may be applicable to the plant itself or to natural products produced from the plant. This information is presented in one or more of the following fields:

- Voucher specimen images.
- Organoleptic descriptions.
- Macroscopic images and descriptions.
- Microscopic images and descriptions.
- Chromatographic methods (e.g., TLC, HPTLC, HPLC).
- Reviews of certain known adulterants.
- Links to abstracts of relevant publications.

Content sources and presentation

The images, descriptions, and analytical methods presented in the AHPA Compendium are compiled from authoritative contemporary and historical references from around the world. These resources consist of:

- Out of copyright print texts.
- Material identified as permitted for use under Creative Commons usage.
- Current copyrighted references (print texts and web-based material) when inclusion constitutes "fair use" or when permission has been obtained for use from the copyright holder.
- Material donated by volunteers.





As a general rule, content is presented in each botanical entry of the AHPA Compendium exactly as it appears in the source reference, though the content may be rearranged to fit standard presentation templates. In addition, minor corrections or clarifications are occasionally included, for example to citations from older texts.

All of the content of the AHPA Compendium is acknowledged to identify its source.




Who should use the AHPA Compendium?

Companies that buy and sell herbs and other botanicals, manufacturers of herbal products, and botanical

Expert sources

-  Out of copyright texts
-  Creative Commons works
-  Copyrighted references ("fair use" or with permission)
-  Donated material

Section Overview

-  Both textual, commercial sources of information and methods
-  Entries can include multiple images from multiple sources
-  Thorough attribution provides direct references to each source and contributor

Organoleptic Characteristics

Color: Unpeeled – yellowish or purplish brown to dark brown externally and yellowish internally. Peeled – pale yellow

Source: Natural Remedies Pvt Ltd ^[3]

Aroma/Odor: Characteristic


Flavor/Taste: Sweet, sugary

Source: American Herbal Products Association. March 2013. Organoleptic Analysis of Herbal Ingredients. AHPA: 10




Macroscopic Characteristics














"...Root nearly cylindrical up to 2 cm in diameter, externally wrinkled with patches of cork. Fracture, coarsely fibrous

Source: Natural Remedies Pvt Ltd ^[5]

	 Encyclopedia of Life	 Encycloped
 Source: Flora von Deutschland, Österreich und der Schweiz- Otto Wilhelm Thomé (1885) ^[6]	 Foliage Source: Encyclopedia of Life http://eol.org/data_objects/2447928 ^[7]	 Inflorescence Source: Encyclopedia of Life http://eol.org/data_object

Section Overview



-  Macroscopy
 -  Organized by scale
 -  Particular focus on providing references to articles of trade

 <p>Source: Flora von Deutschland, Österreich und der Schweiz- Otto Wilhelm Thome (1885) [6]</p>	 Encyclopedia of Life  <p>Foliage Source: Encyclopedia of Life http://eol.org/data_objects/2447928 [7]</p>	 Encyclopedia of Life  <p>Inflorescence Source: Encyclopedia of Life http://eol.org/data_objects/24932881 [8]</p>
  <p>PlantaPhile©2014 Source: PlantaPhile [9]</p>	  <p>PlantaPhile©2014 Source: PlantaPhile [10]</p>	
  <p>Dried Roots Source: Natural Remedies Pvt.Ltd http://www.naturalremedy.com/ [11]</p>	 Encyclopedia of Life  <p>Dried Roots 2 Source: Encyclopedia of Life http://eol.org/data_objects/19163752 [12]</p>	



Section Overview

Microscopy

- 
 Additional literature source references included when possible
- 
 Images from a variety of contributors and references across the site

Microscopic Characteristics




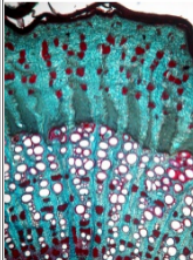
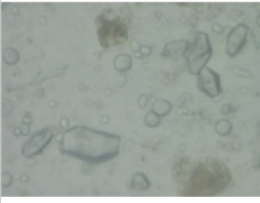
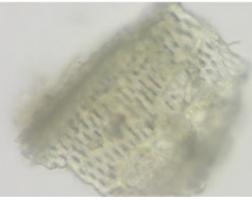
"Transverse section of stolon more or less rounded. Phellem several layered with tabular cells; outer layers filled with reddish brown contents, inner colour Phellogen indistinct; phellogen three to five layered, collenchymatous; some of the cells contain calcium oxalate and minute starch grains. Secondary phlo numerous concentrically arranged bundles of phloem fibres and surrounded by a parenchymatous sheath containing prisms of calcium oxalate. Medullary r. distinct, bi-to multiseriate, parenchymatous, in continuation with those of xylem. The rays are narrower in xylem and wider in phloem region. Xylem consists vessels, fibres and lignified wood parenchyma. The unpeeled drug shows the presence of polyhedral tubular brownish cork cells. In case of stolons, the pit present and is parenchymatous. The root is characterized by the presence of tetrarch xylem and absence of pith.

Powder: It shows plenty of starch grains, hexagonal crystals vessel elements are with reticulate wall pitting."

Source: Natural Remedies Pvt Ltd ^[13]

"The powder is identified by (1.) The character and location of starch-grains and crystals; (2) the very numerous bast-fibers of peculiar appearance and the wood-fibers; (3) The peculiar sieve-tissue. The starch-grains are irregularly spheroidal, mostly solitary, and range from 1.5 ore 2 to 20 microns in diameter. in medullary-ray and parenchyma-cells, and are often associated in the same cell with the monoclinic prismatic crystals of calcium oxalate, sometimes also bast- and wood-fibers are yellow, thick-walled, and doubly pointed. Part of the sieve-tubes have their cavities nearly or quite obliterated by cell-wall thickeni

Source: Hare, Caspari, Rusby. National Standard Dispensatory (1905) ^[14]

		
 <p>Transverse section Source: Natural Remedies Pvt Ltd http://www.naturalremedy.com ^[15]</p>	 <p>Starch granules and hexagonal crystals in powder Source: Natural Remedies Pvt Ltd http://www.naturalremedy.com ^[16]</p>	 <p>Vessels with reticulate thickening in powder Source: Natural Remedies Pvt Ltd http://www.naturalremedy.com ^[17]</p>

Section Overview

High Performance Thin Layer Chromatographic Identification

- High Performance Thin Layer Chromatography
 - Sample plates
 - Comparative methods
 - Multiple reference comparisons with analysis

HPTLC Association

Arnebia root, zi cao (root) (*Arnebia euchroma* or *Arnebia guttata*)

Lane Assignments Lanes, from left to right (Track, Volume, Sample):

1. 3 μ L Arnebia root 1
2. 5 μ L Arnebia root 1
3. **7 μ L Arnebia root 1**
4. 7 μ L Arnebia root 2
5. 7 μ L Arnebia root 3
6. 3 μ L CAMAG test dye mixture III
7. 7 μ L Arnebia root 4 (old sample)
8. 7 μ L Yunnan onosma root
9. 7 μ L Tibetan onosma root

Fig. 1) UV 366 nm

Arnebia root, zi cao (root) HPTLC ID - UV 366 nm

Reference Sample(s) Reference: Dilute CAMAG test dye mixture III 1:10 with toluene.

Stationary Phase Stationary phase, i.e. Silica gel 60, RP-18




Mobile Phase acetone, 5% aqueous formic acid 8:2 (v/v)

Sample Preparation Method Sample: Mix 500 mg of powdered sample with 5 mL of methanol and sonicate for 10 minutes, then centrifuge or filter the solutions and use the supernatants / filtrates as test solutions.

Detection Method Saturated chamber; developing distance 70 mm from lower edge; relative humidity 33%

Other Notes Images presented in this entry are examples and are not intended to be used as basis for setting specifications for quality control purposes.

Section Overview

-  High Performance Liquid Chromatography
-  Information required to reproduce the methods
-  Citations to scholarly papers

High Performance Liquid Chromatographic Identification

Licorice (root) (*Glycyrrhiza glabra*)

Sample Preparations: Extract 1.0 g of coarsely powdered *Glycyrrhiza* root in 50 mL of water by boiling for about 5 minutes, and filter. Repeat for 4-5 times or until the extract is colorless. Combine the extracts, concentrate to about 100 mL, and cool to room temperature. Before injection, filter through a membrane filter of 0.45-um or finer pore size, discarding the first 5 mL of the filtrate.

Column: C18, 25-cm x 4.6 mm, 5-um

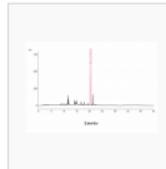
Mobile Phase: 0.14 g of anhydrous potassium dihydrogen phosphate in 900 mL of water, add 0.5 mL phosphoric acid, mix, complete to volume with water, and mix (Solution A); and acetonitrile (Solution B)

Elution: Gradient program, see Table below

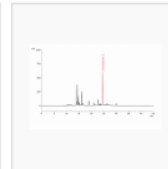
Flow rate: 1.5 mL/min

Detection: UV, 254 nm

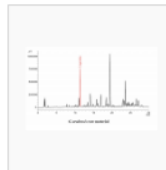
Injection volume: 20 uL



G. glabra root



G. inflata root

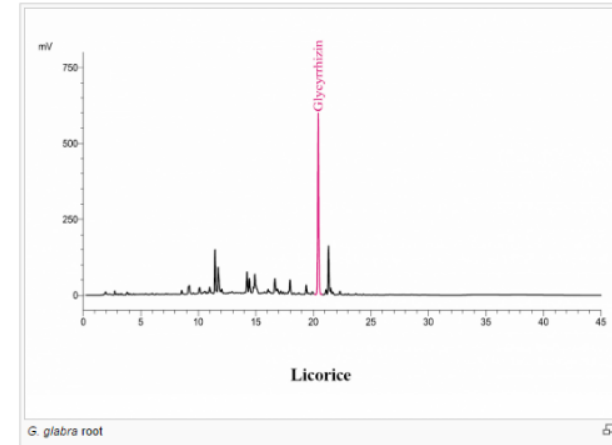


G. uralensis root





Source: Natural Remedies Pvt Ltd ^[18]

Table: Gradient program

Time (min)	Solution A (%)	Solution B (%)
0-18	95-55	5-45



Section Overview

-  *New growth area!*
-  DNA-based identification
 -  Recent research
 -  Compendium format allows for easy additions as further developments proceed

DNA Identification

Black Cohosh (*Actaea racemosa*)

Amplification primers:

NY1400 (5'-CAT TTT CTT GAT TTT CTG GGC TA-3') and NY1401 (5'-CCG GCT TAC TAA TGG GAT G-3')

PCR reaction mixture:

15 µL final volume containing 1.5 µL PCR buffer (200 mM tris [pH 8.8], 100 mM KCl, 100 mM (NH₄)₂SO₄, 20 mM MgSO₄, 1% [v/v] Triton X-100, 50% [w/v] sucrose, 0.25% [w/v] cresol red), 0.2 µM dNTPs, 0.025 µg/µL bovine serum albumin (BSA), 1 µM of each primer, 0.25 units of *Taq* polymerase, and 0.5 µL template DNA.

PCR program: 95°C for 2.5 min; 35 cycles: 95°C for 30 s, 58°C for 30 s, 72°C for 30 s; 72°C for 10 min.

Sequencing primers: Same as amplification primers.

Sequence: 5'-TCT TTC AAG TGT ACG AAA AAA TCC TTC GGT GGT AAG GAG TCA AAT GTT AGA AAA TTC ATT TAT TAT AGA CAT TGC TAT TAA TAA GTT TGA TAC TAT AGT CCC AAT TAT TCC TTT GAT TGG ATT ATT GGC TAA AGC GAA ATT TTG TAA CTT ATC GGG G-3'

Diagnostic positions:

	00000111112222223333444444455566667
	1567946789023444705590004567900501130
	2669211792396679602777892010701063662
A. arizonica	GACAGCCCCCGTATTTCCGCACATTACGCTCACTACG
A. asiaticaT.....TA.G.....T....
A. biternata	----...T.....G..AT.....T..TT
A. cimicifuga	TG.....T.....A.....C.....GT.G..
A. cordifoliaT.....G.....G.....G.....G.....
A. dahurica	---...TT.....A.....CC..T...GT.G..
A. elataT.....AT..G.....G.....
A. pachypodaT.....TA.....T.....T.....
A. podocarpaT.....C.....AT.....A.....



Not a static reference - Contributions welcomed

**AHPA recognizes other
valuable resources exist
regarding the identity of
Aesculus hippocastanum.**

**To submit a suggestion or
contribution, please contact**

[Merle Zimmermann](mailto:Merle.Zimmermann@ahpa.org) .

- Information can be contributed by outside experts
- Templates available to make contribution process easier
- Welcome partnerships and additions at scale
- Offered contributions are reviewed prior to addition by AHPA staff
- Clear attributions of every contributor or editor sourced

THANK YOU!

Michael McGuffin

mmcguffin@ahpa.org

American Herbal Products Association

THE VOICE OF THE HERBAL PRODUCTS INDUSTRY