

Phytolacca americana: A Review

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ABSTRACT

Phytolacca americana (pokeweed) is a common perennial native plant, found in Northern and Central N. America grown in damp rich soils in clearings, woodland margins and roadsides grown upto 10 feet or more. It is used in homoeopathic medicine in order to relieve so many ailments, mainly used to treat obesity and other inflammatory conditions with the extract of different parts of the plant. The phytoconstituents of the pokeweed mainly includes triterpene saponins, triterpene alcohol, lignanes, flavonoles etc. The pokeweed antiviral protein (PAP) in the plant inhibits multiplication of herpes simplex virus, human immunodeficiency virus and used to treat childhood leukemia.

Key Words: Pokeweed, triterpene saponins, Herpes Simplex Virus, childhood leukemia.

INTRODUCTION

Synonyms

Poke Salet, American Pokeweed, Cancer-root, Cancer jalap, Inkberry, Pigeon Berry, Pohan, Poke, Poke Root, Pokeberry, Reujin D Ours, Sekerciboyaci, Skoke, Virginian Poke, Yoshu-Yama-Gobo, Yyamilin

Classification

Kingdom: Plantae
Order: Caryophyllales
Family: Phytolaccaceae
Genus: *Phytolacca*
Species: *americana*

Habitat

Pokeweed is a common perennial native plant, found in Northern and Central N. America from the New England States to Minnesota and south to Florida and Texas, naturalized in Britain and other countries. Growing in damp rich soils in clearings, woodland margins and roadsides.

Cultivation

The plant genus *Phytolacca* encloses 35 species with a close relativity and similar characteristics. Poke plants are shrubs or trees, annual, likewise perennial, the stems are erect up to 1-3 m height. It is an easily

grown plant, succeeding in most soils and full sun or partial shade. The stout erect stalk is tall, growing to 10 feet or more, smooth and branching, turning deep red or purple as the berries ripen and the plant matures. The root is conical, large and fleshy, covered with a thin brown bark. The leaves are pinnate, opposite or appearing whorled, ovate, 10-15 cm long, 4-12 cm broad, margins entire, often undulated and about 5 inches long and 2 to 3 inches wide, simple, alternate, ovate-lanceolate, and smooth. The flowers which appear from July to September are long-stalked clusters and each has 5 whitish petals with green centers. The fruits are red berries, finally becoming black, seeds with perisperm, gleaming black, 10 mm in diameter is a rich deep purple round berry, containing a rich crimson juice. Gather, young edible shoots in spring, the roots in fall, slice and dry for later use, and berries as they ripen. Pokeweed is edible (cooked) and medicinal. It has a long history of use by Native Americans and in alternative medicine. The young shoots are boiled in two changes of water and taste similar to asparagus, berries are cooked and the resulting liquid used to color canned fruits and vegetables.

Folklore

Some Native American tribes used Pokeweed as a Witchcraft Medicine, believing that it's ability to totally purge the body by causing drastic diarrhea and vomiting would also expel bad spirits. Fruit was

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made into a red dye used in painting horses and various articles of adornment.

Plant parts used: Roots, Berries, Leaves

Constituents

In an early work from 1975 following aglycones of *P. dodecandra* berries were found containing Oleanolic acid 66.2 %, bayogenin 14.9 %, hederogenin 8.9 %, 2-hydroxyoleanolic acid 6.5 %, which all are 28-carboxyoleanenes. The saponins in the berries of the following species like *P. americana*, *P. dioica*, *P. octandra*, *P. rivinoides*, and *P. esculenta* are said to be composed of 28,30-dicarboxy- and/or carbomethoxy oleanenes¹. In the whole plant triterpene saponines and *Phytolacca* mitogenes, in the leaves the flavanols astragalin and isoquercetrin, and in the epidermis cells oxalate crystals² found.

Constituents of the ripe berries: (*Phytolacca americanae fructus, poke berries*)

Betacyanines: Phytolaccin, the red coloured sap of the fruits contains mainly (95 %) of betanin.

Triterpensaponins

The hydrolysis resulted in the aglyca esculentic acid, jaligonic acid, phytolaccagenic acid, pokeberrygenine, and a little bit of acinosolic acid. In the seeds 3-acetyloleanolic acid and 3-acetylauritolic acid could be found. In the seeds lot of triterpene alcohols like amyirin, cycloartenol, lanosterol, lupeol could be found together with starch, proteins (10 %), PAP-S, a specific protein and further fatty oils (11-13 %).

Lignanes

From the seeds the neolignanes americanine A, B, D and americanol A and isoamericanol A could be isolated².

Saponins

The dried berries of *P. dodecandra*, known as "endod" or "soapberry" contain up to 25 % (w/w) saponines. Monodesmosidic oleanolic acid acts as a molluscicidal saponin, while bidesmosidic compounds of oleanolic acid are inactive, like hederogenin and bayogenin. The isolated saponines are white amorphous powders, soluble in methanol. Mass-spectrometric values were in the range 499(A-H) and 661(M-H). Sugars were glucopyranose and rhamnose³.

Constituents of the root: (*Phytolacca Americanae radix, poke root*)

Triterpensaponins

Phytolaccosides A, B (= *phytolacca saponine G*), D, D2, E (= *phytolacca-saponine E*) and *Phytolacca saponine B*. After acid hydrolysis the aglyca were, esculentic acid, jaligonic acid, jaligonic acid- 30-methyl ester (=phytolaccagenin, esculentic acid-30-methylester (phytolaccagenic acid). The saponines are monodesmosidic mostly with a short unbranched sugar chain from which glucose and xylose could be derived.

Proteins

Out of the fresh root five glycoproteins (Pa-1 to Pa-5) could be won (PWM = Poke Weed Mitogen). They are mitogenic active, with 19 % cysteine and 4-5 % carbohydrate, and PAP-R (Poke weed antiviral protein from the root) an antiviral compound.

Further compounds are: 0.13 %-0.16 % histamine, gamma-aminobutyric acid, alpha spinasterol, stigmasterol, starch, saccharose, and potassium salts like KNO₃.

USES

Aching, soreness, restlessness, prostration, are general symptoms guiding to *Phytolacca*. Pre-eminently a remedy for glandular swellings with heat and inflammation. Has a powerful effect on fibrous and osseous tissues; fasciae and muscle sheaths; acts on scar tissue. Syphilitic bone pains; chronic rheumatism. Sore throat, quinsy, and diphtheria. Tetanus and opisthotonos. Decrease of weight. Retarded dentition.

Head

Vertigo on rising. Brain feels sore. Pain from frontal region backward. Pressure in temples and over eyes. Rheumatism of scalp; pains come on every time it rains. Scaly eruption on scalp.

Eyes: Feeling of sand under lids. Tarsal edges feel hot. Fistula lachrymalis

Nose: Coryza; flow of mucus from *one nostril and from posterior nares*.

Mouth

Teething children with irresistible desire *to bite the teeth together*. Teeth clenched; lower lip drawn down; lips everted; jaws firmly set; chin drawn down on sternum. Tongue *red tip*, feels rough and scalded; bleeding from mouth; blisters on side. Mapped, indented, fissured, with yellow patch down center. Much stringy saliva.

Throat

Dark red or bluish red. Much pain at root of tongue; soft palate and tonsils swollen. Sensation of a lump in throat. *Throat feels rough, narrow, hot. Tonsils swollen, especially right; dark-red appearance. Shooting pain into ears on swallowing.* Pseudo-membranous exudation, grayish white; thick, tenacious yellowish mucus, difficult to dislodge. Cannot swallow anything hot. Tension and pressure in parotid gland. Ulcerated sore throat and diphtheria; Uvula large, dropsical. *Quinsy; tonsils and fauces swollen, with burning pain; cannot swallow even water. Mumps. Follicular pharyngitis.*

Abdomen

Sore spot in right hypochondrium. Rheumatism of abdominal muscles. Colic at navel. Burning griping pains. Bruised feeling through epigastrium and abdomen. Constipation of the aged and those with weak heart. Bleeding from rectum.

Urine: Scanty, suppressed, *with pain in kidney region.* Nephritis.

Female

Mastitis; *mammæ hard and very sensitive.* Tumors of the breasts with enlarged axillary glands. Cancer of breast. Breast is hard, painful and of purple hue. Mammary abscess. When child nurses, *pain goes from nipple all over body.* Cracks and small ulcers about nipples. Irritable breasts, before and during menses. Galactorrhoea. Menses too copious and frequent. Ovarian neuralgia of right side.

Male

Painful induration of testicles. *Shooting along perineum to penis.*

Heart

Feeling as if heart leaped into throat. Shock of pain in cardiac region alternating with pain in right arm.

Respiratory

Aphonia. Difficult breathing; dry hacking, tickling cough; worse at night. Aching pains in chest, through mid-sternum; with cough. Rheumatism of lower intercostals.

Back

Aching pains in lumbar region; pains streaking up and down spine into sacrum. Weakness and dull pain in region of kidneys. Back stiff, especially in morning on rising and during damp weather.

Extremities

Shooting pain in right shoulder, with stiffness and inability to raise arm. Rheumatism pains; worse in morning. *Pains fly like electric shocks,* shooting, lancinating, shifting rapidly. Pain in under side of thighs. Syphilitic sciatica. *Aching of heels;* relieved by elevating feet. Pains like shocks. Pain in legs, patient dreads to get up. Feet puffed; pain in ankles and feet. Neuralgia in toes.

Fever: High fever, alternating with chilliness and great prostration.

Skin

Itches, becomes dry, shrunken, pale. Papular and pustular lesions. Most useful in early stages of cutaneous diseases. *Disposition to boils,* and when sloughing occurs. Squamous eruptions. Syphilitic eruptions. Swelling and induration of glands. *Venereal buboes.* Scarlatina-like rash. Warts and moles.

Modalities

Worse, sensitive to electric changes. Effects of a wetting, when it rains, exposure to damp, cold weather, night exposure, motion, right side. *Better,* warmth, dry weather, rest.



Plant



Roots



Berries

Current trends carrying out on this plant

Anti-AIDS

Pokeweed antiviral protein (a Single Chain Ribosome Inactivating Protein or SCRIP) is being considered as a potent inhibitor of human immunodeficiency for AIDS. There are also three different well-known pokeweed antiviral protein (PAP) isoforms from leaves of *Phytolacca americana* (PAP-I from spring leaves, PAPII from early summer leaves, and PAP-III from late summer leaves) that cause concentration-dependent depurination of genomic HIV-1 RNA⁴. When PAP is conjugated to antibodies specific to cell surface receptors the antiviral activity of PAP is much improved and highly cell selective. This conjugate inhibits HIV-1 replication at picomolar concentrations. Fortunately, the proliferation of

normal CD4 T cells is not inhibited at these concentrations. The conjugate has been used in vivo in mice and cynomolgus monkeys, with no significant side effects^{5,6}.

New research has revealed that a possible CURE for Childhood Leukemia called (B43-PAP) is found in the common Pokeweed. Anti-B43-pokeweed antiviral protein, B43-PAP, PAP is a pokeweed toxin. The B43 carries the weapon--the PAP--to the leukemia cells. The two parts of this drug are the B43 antibody (or anti-CD19) and the pokeweed antiviral protein (PAP) immunotoxin, a natural product in the pokeweed plant. B43 is designed to recognize specific B-cell leukemia cells just as natural antibodies attack and recognize germs. When the antibody finds a leukemia cell, it attaches and B43 delivers the other part of the drug, PAP. Inside the cell, PAP is released by the antibody and inactivates the ribosomes that make the proteins the cell needs to survive. With the cell unable to produce proteins, the specific leukemia cell is killed (report from Parker Hughes Institute).

Antiviral activity: inhibition of herpes simplex virus multiplication by the poke root antiviral protein⁷.

Hepatotoxicity of aqueous extract and fractionated methanol extract of *Phytolacca americana* by isolated rat liver perfusion system⁸.

Anti-cancer activity

The anticancer effects mainly based upon anti-tumor and anti-inflammatory properties, along with immune stimulant functions and further support for fighting cancer may come from antiplasmodial or cytotoxic fractions of the phytolacca toxin. Further there are aromatase inhibitors and antioxidant properties that may affect cancer. Anti-cancer, antileukemic or anti-tumor constituents include: ascorbic acid, astragaloside, betacarotene, caryophyllene, isoquercetin, oleanolic acid, riboflavin, tannin and thiamine. Of the constituents known to fight cancer, oleanolic acid appears to be the most significant with its anticarcinomic, anticomplement, antihepatotoxic; antiinflammatory, antileukemic; antileukotriene, antinephritic, antioxidant, antiperoxidant, antiPGE2, antiplasmodial, antisarcomic; antiseptic, antiTGFbeta, antitumor (Breast, Colon, Kidney, Lung, Pancreas); antiviral, aromatase inhibitor; cancer-preventive; hepatoprotective; immunomodulator; leucocytogenic; NF-κB-Inhibitor; phagocytotic; and prostaglandin-synthesis inhibitor properties⁹.

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