A review on chemical and biological properties of *Cayratia trifolia* Linn. (Vitaceae)

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ABSTRACT

Cayratia trifolia Linn. Domin Syn. Vitis trifolia (Family: Vitaceae) is commonly known as Fox grape in English; Amlabel, Ramchana in Hindi and Amlavetash in Sanskrit. It is native to India, Asia and Australia. It is a perennial climber having trifoliated leaves with 2-3 cm long petioles and ovate to oblong-ovate leaflets. Flowers are small greenish white and brown in color. Fruits are fleshy, juicy, dark purple or black, nearly spherical, about 1 cm in diameter. It is found throughout the hills in India. This perennial climber is also found in the hotter part of India from Jammu and Rajasthan to Assam extending into the peninsular India upto 600 m height. Whole plant of *Cayratia trifolia* has been reported to contain yellow waxy oil, steroids/terpenoids, flavonoids, tannins upon preliminary phytochemical screening. Leaves contain stilbenes (piceid, reveratrol, viniferin, ampelopsin). Stem, leaves, roots are reported to possess hydrocyanic acid, delphinidin and several flavonoids such as cyanidin is reported in the leaves. This plant also contains kaempferol, myricetin, quercetin, triterpenes and epifriedelanol. Infusion of seeds along with extract of tubers is traditionally given orally to diabetic patients to check sugar level of blood. Paste of tuberous is applied on the affected part in the treatment of snake bite. Whole plant is used as diuretic, in tumors, neuralgia and splenopathy. Its climbers wrapped around the neck of frantic bullock and poultice of leaves are used to yoke sores of bullock. The bark extract shows the antiviral, antibacterial, antiprotozoal, hypoglycemic, anticancer and diuretic activity. This article focuses on the upgraded review on chemical and biological properties of *Cayratia trifolia* Linn. and triggers further investigation on this plant.

Key words: Biological, *Cayratia trifolia*, chemical, review

INTRODUCTION

According to World Health Organization, traditional medicine is defined as diverse health practices, approaches, and knowledge and believes incorporating plant, animal and/or mineral-based medicines, spiritual therapies, manual techniques and exercises applied singularly or in combination to maintain well-being as well as to treat, diagnose or prevent illness.[1,2] More than 35,000 plant species are being used in various human cultures around the world for medicinal purposes.[3] Crude drugs are usually the dried parts of medicinal plants (roots, stem wood, bark, leaves, flowers seeds, fruits and whole plants, etc.) that form the essential raw materials for the production of traditional remedies in various systems of medicines like Ayurveda, Siddha, Unani, Homeopathy, Tibetan, etc.

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Cayratia trifolia Linn. Domin syn. *Vitis trifolia* Linn. (Family:Vitaceae) is a native of India, Asia and Australia.[4] It is a perennial climber, found in the hotter parts of India from Jammu and Rajasthan to Assam, Tripura and West Bengal extending into peninsular India up to 600 m.[5,6]

Synonyms

Cayratia trifolia is also known by various synonyms[7-11] such as:
Vitis trifolia Linn.
Cissus carnosa Lamk.
Vitis carnosa (Lamk.) Wall.ex M. Lawson
Cissus trifolia (Linn.) K. Schaum
Cayratia carnosa (Lamk.) Gagnep

Local names

Different vernacular names[6] of *Cayratia trifolia* have been reported in Table 1.

Taxonomical hierarchy

The taxonomical hierarchy[4,13] of *Cayratia trifolia* has been mentioned in Table 2.

Botanical distribution

Cayratia trifolia is a weak herbaceous climber, woody at base, stem is more or less succulent, compressed and densely. Leaves are trifoliolate with petioles 2-3-cm long. Leaflets are ovate to oblong-ovate, 2-8-cm long, 1.5-5-cm wide, pointed at the tip. Flowers are small greenish white 2.5mm, and brown on solitary cymes in leaf axils.[12,14,15] Fruits are fleshy, juicy, dark purple or black, nearly spherical and about 1 cm in diameter [Figure 1]. Seeds are triangular, apex rounded, ventral holes and ribs obtuse along margin, slightly raised.[17]

Geographical distribution

Cayratia trifolia is known as kalit--kalit in Philippines where it is found at low altitudes. It is also found from India to southern China, through the Malaya to the Moluccas and the Caroline Islands. It also found throughout the hilly regions in India.[17,18] This perennial climber also grows wildly in Jammu, Rajasthan, Assam, Tripura and West Bengal extending into peninusular India up to 600 m.[6] This plant is also distributed in Bangladesh, Burma, Ceylon, Combodia, Indonesia, Laos, Makaysia, Malacca, Pakistan, Thailand and Vietnam.[19,20] It is found in tropical and subtropical areas of Asia, Africa, Australia and Island of the Pacific Ocean.[21]

Chemical constituents

This plant also contains kaempferol, myricetin, quercetin, triterpenes and epifriedelanol.[22] Whole plant of *Cayratia trifolia* has been reported to contain yellow waxy oil, steroids/terpenoids, flavonoids, tannins.[6] Leaves contain stilbenes such as piceid, reveratrol, viniferin and ampelopsin.[35] Stem, leaves and roots are reported to possess hydrocyanic acid and delphinidin. Several flavonoids such as cyanidin are reported in the leaves.[23,24] Its seeds and fruits showed presence of cyanogenic compounds. Fruits also contain calcium oxalate responsible for severe irritation in the mouth.[6]

Ethnomedicinal uses

Whole plant is used as diuretic and is also useful in tumors, neuralgia and splenopathy, leucorrhea,[6,16] astringent.[31] Leaves, root and seeds are used as poultice to ulcers and boils.[8,14,16] Fermentation of hot decoction of leaves and root is used as diaphoretic[8] and recommended in high fever [16]. Sap of stems and juice of leaves are used as aphrodisiac.[23] Root is used to reduce anemic condition, stomachic diseases, as an astringent[27] and paste as an antidote in snake bite, also in complained of carencules.[3,6,25,26] Extract of tuber along with infusion of *Cayratia trifolia* seeds is given orally to diabetic patients to check sugar level of blood whereas powder of tuberous root is taken orally with the milk for the early recovery of fractured bone.[25,26] Leaves are Rubifacient,[29] used to stop bleeding of injuries.[29,30] Root bark reduces the muscular pain.[31]

Table 1: Vernacular names of *Cayratia trifolia*

Language	Vernacular names
Assam	*Ghepeta-lat, Chepeta lota*
Bengali	*Amla-lata*
English	*Fox-grape*
Gujrati	*Khat-khatumbo*
Hindi	*Amal-bel, Ramchana, Teen panya kand, Amar chatioo, khhata-limba, Tamnaya, Gidardrak*
Karnataka	*Heggoli*
Malyalam	*Sorivalli*
Marthi	*Ambat-vel*
Punjabi	*Armal-bel*
Sanskrit	*Amlavetash, Atyamlaparni, Gandiran.*

Table 2: Taxonomical hierarchy of *Cayratia trifolia*

Taxonomical hierarchy	Names
Domain	*Eukaryota*
Subkingdom	*Viridaeplantae*
Kingdom	*Plantae*
Phylum	*Tracheophyta*
Subphylum	*Euphyllophytina*
Infraphylum	*Radiatopses*
Class	*Magnolipsida*
Subclass	*Rosidae*
Suborder	*Vitanae*
Order	*Vitales*
Family	*Vitaceae*
Subfamily	*Vitoideae*
Genus	*Cayratia*
Species	*trifolia*

Figure 1: Major phytochemical constituents of *H. spinosa*

Therapeutic uses

Paste of *Cayratia trifolia* is applied locally by the tribal's for early cure of wounds and edema[9,25]. Roots are grounded with black peeper and applied as poultice on boils.[15,29,31] Root paste is mixed with coconut oil and applied as decoction for 3 days.[29] Leaf paste of *Gymnema sylvestris* and *Cayratia trifolia* is applied locally in eczema.[32]

Pharmacological uses

The 50% ethanolic extract of the plant (excluding root) in a preliminary biological screening showed gross behavioral effect and hypothermia. The bark extract showed 40-59.9% inhibition of potato virus. The plant is reported to have antibacterial, antifungal, antiprotozoal, hypoglycemic, anticancer and diuretic actions.[6]

Veterinary uses

Poultice of leaves are used for yoke sores of bullock and also used to cure swelling, injury and infection.[16,29,31] Climbers are wrapped around the neck of a frantic bullock.[17,31]

Non-medicinal uses

Fruits are edible, pleasantly acidic in taste.[8] Stem bark is used to make net and ropes.[34]

IN VIVO AND *IN VITRO* RESEARCH AND PHARMACOLOGICAL ACTIONS

Antioxidant activity

The powdered plants were continuously extracted with petroleum ether, chloroform, ethyl acetate and methanol. The crude extract of ethyl acetate and methanol were tested for their biological activity including antioxidant activity by scavenging effect on DPPH (1,1-diphenyl-2-picryl hydraryl) radicals. The crude extract of *Cayratia trifolia* showed the ED_{50} values of 10.24 and 11.36 g/ml, respectively.[36]

Antimicrobial activity

Crude extract of this plant was tested in preliminary biological screening for their antimicrobial activity against *Escherichia coli, Bacillus subtilis, Micrococcus luteus* and *P. oxalium*. Precleaned extract was also investigated for their ability to inhibit protein kinase and tyrosine-specific protein kinase of epidermal growth factor.[37]

Anticancer activity

A large variety of phytochemical constituents that have been reported from natural product research has been proven successfully as anticancerous agent. The finding from the study reveals that methanolic extract is more potent than aqueous extract in exerting antineoplastic effect in both cell lines as evident by a dose dependent decrease in cell growth. The effect was analysed at different concentration level ranging from 50 to 500 µg/ml. Delphidin and cyaniding which are anthocyanin and showed antiproliferative and proapoptotic properties in gastric adenocarcinoma and were also found to be protective against esophageal cancer in rodents.[38]

Neuroprotective effect

The dietary supplementation with resveratrol significantly reduced plaque formation in animal brains, a component of Alzheimer and other neurodegenerative disease.[39] In mice, oral resveratrol produced large reductions in brain plaque in the hypothalamus(-90%), Striatum(-89%) and redial cortex (-48%) section of the brain in humans. In humans it is theorized that oral doses of resveratrol may reduce β-amyloid plaque associated with aging changes in the brain.[40-43]

Anti-inflammatory effect

In a rat model of carrageenan-induced Paw edema, resveratrol inhibited both acute and chronic phases of the anti-inflammatory process.[44]

Cardioprotective effects

- It inhibits the vascular cell adhesion molecular expression. [45,46]
- Inhibition of vascular smooth muscle cell proliferation[47-49]
- Stimulation of endolethelial nitric oxide synthase activity[50-52]
- Inhibition of platelet aggregation[53-55]

Antidiabetic effect

It possesses hypoglycemic and hypolipidemic effect in both Streptozotacin-induced diabetes rats and STZ-Nicotinamide-induced diabetes rats. Other diabetic animal model studies by different researches have also demonstrated the antidiabetic effect of resveratrol.[56-61]

Antiviral effect

It inhibits herpes simplex virus types 1 and 2 replication by inhibition of an early step in virus replication cycle. *In vivo* studies in mice shows that resveratrol inhibits or reduce HSV replication in the vagina and limits extra-vaginal disease.[62-64] Studies also show that resveratrol inhibits varicella-Zoster virus, certain influenza viruses, human cytomegalovirus. Furthermore, resveratrol synergistically enhances the anti-HIV-1 activity of several anti-HIV drugs.[65-70]

CONCLUSIONS

Cayratia trifolia Linn. is a medicinally important plants and used in the treatment of various diseases in Indian system of medicine. This paper provides valuable information about plant. Such information may serve as a base for new pharmacognostical, phytochemical, pharmacological, toxicological and clinical research.

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