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A REVIEW OF THE PHYTOCHEMICAL AND PHARMACOLOGICAL CHARACTERISTICS OF *CAYRATIA TRIFOLIA*

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ABSTRACT

Cayaratia trifolia is an appraised medicinal plant in conventional folk medicine. Many pharmacological studies of this plant have shown antiviral, antibacterial, antiprotozoal, hypoglycaemic, anticancer and diuretic activity. This review is a broad summary of the phytochemical and pharmacological activities of this plant *Cayratia trifolia.* This plant also has broad traditional and pharmacological uses in numerous pathophyisiological conditions. In this article, we will mainly review the numerous properties of *Cayratia trifolia(*Bush grape*)* and focus on its various medicinal properties. We expect that this is an attractive topic for further experimental and clinical investigations.

KEYWORDS: *Cayratia trifolia, pharmacological action, phytochemistry.*

List of abbreviations

CT: *Cayratia trifolia*
WHO: World Health Organization
GC-MS: Gas Chromatography-Mass Spectrometry
FTIR: Fourier transform infrared spctroscopy
NMR: Nuclear magnetic resonance spectroscopy
HPLC: High Performance Liquid Chromatography
HPTLC: High Performance thin layer chromatography
RP-HPLC: Reversed phase High Performance liquid chromatography
FRAP: Ferric reducing antioxidant power
OECD: Organisation for Economic Cooperation and Development

INTRODUCTION

According to World Health Organization(WHO), Traditional medicine may be defined as the sum total of the knowledge, skill and practices based on theories. beliefs and experiences indegenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness.[1,2] More than 35,000 plant species are being used for medicinal purposes around the world for human use.[3] Crude drugs are generally the dried parts of the medicinal plants which includes the roots, stems, bark, leaves, flowers, seeds, fruits and whole plants which form the essential raw materials for production of traditional medicine in numerous medicinal systems such as Ayurveda, Siddha, Unani, Homeopathy, etc.[4,5] *Cayratia trifolia* (CT), also known as Bush grape is native of Asia and Austrailia.[6,7] In India, it is found in the hotter regions from Jammu and Rajasthan to Assam, Tripua and West Bengal extending into peninsular India upto an altitude of 600 m.[8,9] The geographical distribution of *Cayratia trifolia* in India is depicted in figure.1. *Cayratia trifolia* is a weak herbacious climber and woody at base. The stem is succulent, compressed and dense. Leaves are trifoliate and leaflets are ovate to oblong-ovate and pointed at the tip.[10,11] Flowers are small greenish white and brown on solitary cymes in leaf axils.[12] Fruits are fleshy, juicy, dark purple or black and nearly spherical in shape. It is depicted in figure. 2. Seeds are triangular and apex is rounded.[13]

Fig. 1: Geographical distribution of *Cayratia trifolia* in India.

This review is mainly focussed on the phytochemistry and pharmacological activity of the plant. The taxonomical classification of Cayratia trifolia is depicted in Table.1.

Table no. 1.

Taxonomical Classification 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

PHYTOCHEMISTRY

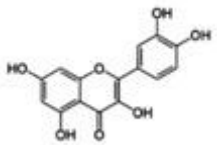
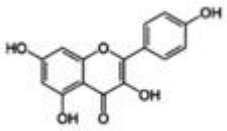
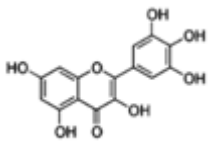
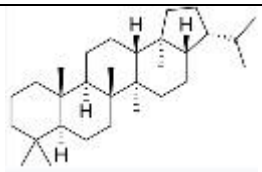
A visual depiction of CT plant is shown in figure.2. The whole plant is a depot of many ingredients, among which the major ones are alkaloids, flavonoids(mainly kaempferol, quercetin and myricetin), tannins, steroids/terpenoids and yellow waxy oil.[8,17] Stilbenes such as piceid, reveratrol, viniferin are ampelopsin are stored in leaves.[14] A list of some important phytoconstituents and their structures are depicted if Table.2. GC-MS(Gas Chromatography-Mass Spectrometry) analysis of the whole plant revealed a total of 20 bioactive compounds. Among which, the important compounds isolated were Cyclopentadecane, 9-Borabicyclo[3.3.1]nonane, 9-(2-propen-1-yloxy)-.1, 4,8,12,16-Tetramethylheptadecan-4-olide, Oxirane and Vitamin E.[15] Fuctional RNA containing polysaccharides, polyphenols and other secondary metabolites was isolated from CT plant tissue by Qiagen method.[16] The ethanolic extract of stem and leaves was analysed and showed presence of high number of primary metabolites.[6] The presence of linoleic acid was confirmed in the ethanolic extract of CT plant by FTIR(Fourier transform infrared spctroscopy) and NMR (Nuclear magnetic resonance spectroscopy) method.[18] HPTLC(High Performance thin layer chromatography) analysis of ethanolic extract of CT showed the presence of tannins and phenol compounds.[19] Resveratrol was isolated from the tissue culture of CT plant.[20] RP-HPLC(Reversed phase High Performance liquid chromatography) analysis of CT plant proved the prensece of phytoestrogens such as daidzein, genistein and formononetin in the plant.[21] Column Chromatography of the CT stem showed the presence of n-tetradecanyl n-octadec-9, 12-dienoate, n-tridecanyl n-octadec-9, 12-dienoate, n-hexadecanyl n-octadec-9, 12-dienoate, n-

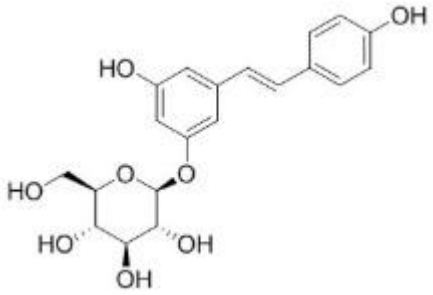
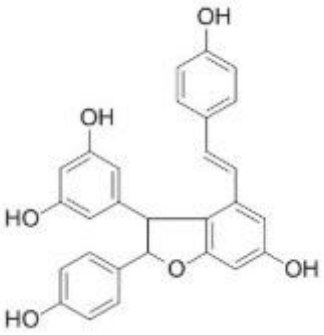
tetradecanyl n-octadec-9-enoate and n-hexadecanyl n-octadec-9-enoate.[22] The ethanolic extract of CT plant showed the presence of amine, acid, alkane, ketone acyclic, carbonyl, aromatic, ester and alkene after being analysed by FTIR method, presence of alkaloids, flavonoids, glycosides, saponin and steroids was proved by HPTLC analysis and the presence of hexadecanoic acid-ethylester, phytol, tetratetracontane, stigmasterol, nonacosane and octadecane-1-bromo was analysed and proved by GC-MS method.[23]

Fig. 2: *Cayratia trfolia* plant.

Table no. 2.

Phytoconstituents of Cayratia trifolia with structures

Serial. no.	Name of componds	Chemical structure
1.	Quercetin	
2.	Kaempferol	
3.	Myricetin	
4.	Triterpine	

5.	Piceid	
6.	Viniferin	

PHARMACOLOGICAL ACTIONS

Antidiabetic activity: The ethanolic extract of roots of *Cayratia trifolia* showed antidiabetic effect in Alloxan induced diabetes in Albino rats.[24] Acute toxicity study of the ethanolic extract of the roots of CT was performed following the OECD guideline No. 420 to check the toxicity in rats.[25] A detailed study was performed to determine the effect of ethanolic extract of CT root on lipid profile, body weight, glucose, plasma and insulin level.[26] A study was done in which the diabetic rats showed hypercholesterolemia and hypertriglyceridemia and extract treated rats showed decreased cholesterol level and triglyceride and increased HDL.[27] Elevation of plasma levels of urea and creatinine was seen in diabetic rats which was decreased in extract treated rats. Thus, it was concluded that the CT root extract showed potential in decreasing the blood glucose level and other complications associated with diabetes in the experimental rats.[28] The ethanolic extract of CT stem also showed antidiabetic activity in streptozocin induced diabetes in mice.[32]

Antioxidant activity: The primary metabolites was analysed qualitatively and quantitatively in *Cayratia trifolia* leaves and stems.[29] The antioxidant properties was evaluated by checking the FRAP (Ferric reducing antioxidant power), catalase activity, LPO (Lipid peroxidase) and peroxidase activity of the leaves and stem of CT.[30] Thus it was concluded that the ethanolic extract of stem and leaves of *Cayratia trifolia* contains high amount of primary metabolites and exhibits free radical scavenging activities after acceptable results

were shown by FRAP, catalse activity, LPO and Peroxidase activity.[6] The antioxidant property of CT stem was also evaluated by DPPH activity in which the concentration of antioxidant that caused loss of 50% of DPPH activity was measured by comparison to ascorbic acid.[31] The IC_{50} value of the extract was found to be more than that of ascorbic acid which proved the presence of strong antioxidant properties.[32]

Hepatoprotective activity: The ethanolic extract of the whole plant of CT showed hepatoprotective activity. A detailed study was done to evaluate the hepatoprotective activity of CT plant against Nitrobenzene induced hepatotoxicity in rats.[33] The activities of liver biomarker such as ALT, AST and ALP was measured using the serum of diseased and treated groups. The nitrobenzene induced group showed increased levels of ALT, AST and ALP which was decreased in the extract treated group.[34] The antioxidant enzymes such as SOD, Catalase and GP_x showed increased activity which was decreased in the diseased group.[35] Lipid peroxidation was also decreased in the extract treated group. Thus, it was concluded that *C. trifolia* leaves extract has potent hepatoprotective action on NB induced hepattotoxicity in rats.[36]

Gastric-antiulcer activity: Methanolic extract of CT leaves showed gastric-antiulcer activity in pylorus ligated and ethanol induced ulcer model in wistar rats.[37] A deatiled examination of the ulcer index, percentage protection of ulcer, effect on pH of gastric juice and effect on gastric juice was compared between diseased and extract treated group.[38] The extract treated group decreased the levels of pH of gastric juice, ulcer index, percentage protection of ulcer and gastric juice secretion in both pylorus ligated and ethanol induced ulcer in rats. Thus it was concluded that due to the antisecertory and cytoprotective activities of CT leaves it possess antiulcer activity.[39]

Anticancer activity: The ethanolic extract of CT plant possess anticancer activity. A detailed study was done using female Sprague dawley rats which was cancer induced by DMBA.[40] MMP-9 and VEGF-A was compared between cancer and treated group. The extract treated group showed reduced expression of Matrixmetalloproteinase-9 (MMP-9) and Vascular endothelial growth factor (VEGF) as compared to the cancer induced group. Thus it was concluded that *Cayratia trifolia* possess anticancer activity.[41]

Antimalareal activity: Water extract of CT leaf have larvaecidal activity against *Culex quinquefasciatus*.[42] The study was carried out in detail and the mortality rate of the larvae of

Culex quinquefasciatus was noted with respect to the type of leaves(mature or young), concentration of leaf extract and between seasons. The water extract of CT leaf showed increased mortality of test mosquito species within 24hrs with increased LD_{50} and LD_{90} whereas no mortality was shown in non-target water population.[43] Presence of steroids, triterpene glycosides, essential oil, phenolics and diterpenes as secondary phytochemicals was evaluated by chromatographic analysis of CT leaf. So it was concluded that water extract of CT leaf have potent antimalareal activity.[44]

CONCLUSION

The main aim of this review was to unravel and investigate the pharmacological and medicinal values of *Cayratia trifolia*. Priclinical studies of the plant revealed the antidiabetic, antiulcer, antipyretic, hepatoprotective, antioxidant, anticancer and antimalareal activity. These actvities may be imputed to the phytoconstituents present in the roots, stem, bark, leaf, flower and seeds of CT. CT provide immense value which can be the basis of drug supplementation. It may be also used for the treatment of different diseases as an alternative therapy.

BIBLIOGRAPHY

1. Qi Z. Who traditional medicine strategy 2014-2023. Geneva: World Health Organization, 2013.
2. Burton A, Smith M, Falkenberg T. Building WHO's global strategy for traditional medicine. European Journal of Integrative Medicine, 2015; 7: 13-5.
3. World Health Organization. Foodborne disease outbreaks: guidelines for investigation and control. World Health Organization, 2008.
4. Rios JL, Recio MC. Medicinal plants and antimicrobial activity. Journal of ethnopharmacology, 2005; 100: 80-4.
5. Bandaranayake WM. Quality control, screening, toxicity, and regulation of herbal drugs. Modern Phytomedicine, 2006; 1: 25-57.
6. Jasuja ND. Evaluation of Primary Metabolites and Antioxidant Potential Activity of Cayratia trifolia (Leaf and Stems). Journal of Drug Delivery and Therapeutics, 2019; 9: 367-72.
7. Purushothaman S, Viswanath S, Kunhikannan C. Economic valuation of extractive conservation in a tropical deciduous forest in Madhya Pradesh, India. Tropical ecology, 2000; 41(1): 61-72.

8. The Wealth of India: A Dictionary of India Raw Material and Industrial Products. New Delhi, India: CSIR, 2004; 3: 399-400.
9. Gupta AK, Sharma M. Review on Indian Medical Plants. New Delhi, India: ICMR, 2007; 5: 879-82.
10. Garden CA, Bennet HW. The Toxic Plant of Western Australian Path. West Aust News Paper, 1956.
11. Vardana R. Direct use of medical plant and their identifi cation. New Delhi, India: SARUP and Sons, 2008; 1: 177.
12. Pulliah T. Encyclopedia of World Medical Plants. India: Regency, 2006; 1: 492.
13. Tutul E, Uddin MD. Z, Angiospermic fl ora of Ructia Sal Forest (Bangladesh). Bangladesh J Plant Taxon, 2010; 17: 33-45.
14. Arora J, Roat C, Goyal S, Ramawat KG. High Stilbenes accumulation in root culture of *Cayratia trifolia* (L.) Domin grown in shake fl ask. Acta Physiol Plant, 2009; 31: 1307-11.
15. Perumal PC, Sowmya S, Pratibha P, Vidya B, Anusooriya P, Starlin T, Vasanth R, Sharmila DJ, Gopalakrishnan VK. Identification of novel PPARγ agonist from GC-MS analysis of ethanolic extract of Cayratia trifolia (L.): a computational molecular simulation studies. J App Pharm Sci., 2014; 4: 006-11.
16. Yazid RM, Sidik NM. Extraction of functional total RNA from Cayratia trifolia. Advances in Environmental Biology, 2011; 5(10): 3404-9.
17. Sowmya S, Perumal PC, Anusooriya P, Vidya B, Pratibha P, Malarvizhi D, Gopalakrishnan VK. Comparative preliminary phytochemical analysis various different parts (Stem, Leaf and Fruit) of Cayratia trifolia (L.). Indo American Journal of Pharmaceutical Research, 2015; 5(1): 218-23.
18. Perumal PC, Sowmya S, Pratibha P, Vidya B, Anusooriya P, Starlin T, Ravi S, Gopalakrishnan VK. Isolation, structural characterization and in silico drug-like properties prediction of a natural compound from the ethanolic extract of Cayratia trifolia (L.). Pharmacognosy research, 2015; 7(1): 121.
19. Gopalakrishnan VK. In vitro Antioxidant Activity, In vivo Skin Irritation Studies and HPTLC Analysis of Cayratia trifolia (L.) Domin.
20. Roat C, Saraf M. Isolation and Screening of Resveratrol Producing Endophytes from Wild Grape Cayratia Trifolia. International Journal of Advances in Agricultural Science and Technology, 2017; 4(11).

21. Gour K, Sharma P, Patni V. "Nano based enhancement and RP-HPLC quantification of daidzein, genistein and formononetin in cayratia trifolia"-a bone-healing plant of semi-arid lands.
22. Singh S, Mann R, Sharma SK. Phytochemical analysis and pharmacognostical standardization of stem of Cayratia trifolia (Linn.) Domin. International Journal of Pharmaceutical Sciences and Research, 2012; 3(11): 4503.
23. Sowmya SU, Perumal PC, GOPALAKRISHNAN VK. Chromatographic and spectrophotometric analysis of bioactive compounds from Cayratia trifolia (L.) stem. Int J Pharm Pharm Sci., 2016; 8(6): 57-64.
24. Dhandapani S, Subramanian VR, Rajagopal S, Namasivayam N. Hypolipidemic effect of Cuminum cyminum L. on alloxan-induced diabetic rats. Pharmacological research, 2002 1; 46(3): 251-5.
25. Veeraraghavan P. Expert consultant, CPCSEA. Organization for Economic Cooperation and Developmen (OECD) Guideline, 2000; 420.
26. NASSIRI-ASL M, Zamansoltani F, Abbasi E, Daneshi MM, Zangivand AA. Effects of Urtica dioica extract on lipid profile in hypercholesterolemic rats. EEC., 1986; 24(86).
27. Rao BK, Kesavulu MM, Giri R, Rao CA. Antidiabetic and hypolipidemic effects of Momordica cymbalaria Hook. fruit powder in alloxan-diabetic rats. Journal of ethnopharmacology, 1999; 1; 67(1): 103-9.
28. Batra S, Batra N, Nagori BP. Preliminary phytochemical studies and evaluation of antidiabetic activity of roots of Cayratia trifolia (L.) Domin in alloxan induced diabetic albino rats. Journal of Applied Pharmaceutical Science, 2013; 3(3): 97.
29. Tanwer BS, Choudhary R, Vijayvergia R. In vitro and in vivo comparative study of primary metabolites and antioxidant activity in Spilanthes acmella Murr. Int. J. Biotechnol. Biochem, 2010; 6(5): 819-25.
30. Zou Z, Xi W, Hu Y, Nie C, Zhou Z. Antioxidant activity of Citrus fruits. Food chemistry, 2016; 196: 885-96.
31. Molyneux P. The use of the stable free radical diphenylpicrylhydrazyl (DPPH) for estimating antioxidant activity. Songklanakarin J. sci. technol, 2004; 26(2): 211-9.
32. Yusuf MI, Susanty S, Fawwaz M. Antioxidant and antidiabetic potential of galing stem extract (Cayratia trifolia Domin). Pharmacognosy Journal, 2018; 10(4).
33. Beauchamp RO, Irons RD, Rickert DE, Couch DB, Hamm TE, Lyon JP. A critical review of the literature on nitrobenzene toxicity. CRC Critical Reviews in Toxicology, 1982; 11(1): 33-84.

34. Aristatile B, Al-Numair KS, Veeramani C, Pugalendi KV. Effect of carvacrol on hepatic marker enzymes and antioxidant status in d-galactosamine-induced hepatotoxicity in rats. Fundamental & clinical pharmacology, 2009; 23(6): 757-65.
35. Venukumar MR, Latha MS. Antioxidant activity ofcurculigo orchioides in carbon tetrachloride—induced hepatopathy in rats. Indian Journal of Clinical Biochemistry, 2002; 17(2): 80-7.
36. Kumar D, Sonumol VM, Rathi MA, Thirumoorthi L, Meenakshi P, Gopalakrishnan VK. Hepatoprotective activity of Cayratia trifolia (L.) domin against nitrobenzene induced hepatotoxicity. Lat Am J Pharm, 2011; 30(3): 546-9.
37. Paiva LA, Rao VS, Gramosa NV, Silveira ER. Gastroprotective effect of Copaifera langsdorffii oleo-resin on experimental gastric ulcer models in rats. Journal of ethnopharmacology, 1998; 62(1): 73-8.
38. Dashputre NL, Naikwade NS. Evaluation of anti-ulcer activity of methanolic extract of Abutilon indicum Linn leaves in experimental rats. Int J Pharm Sci Drug Res., 2011; 3(2): 97-100.
39. Gupta J, Kumar D, Gupta A. Evaluation of gastric anti–ulcer activity of methanolic extract of Cayratia trifolia in experimental animals. Asian Pacific Journal of Tropical Disease, 2012; 2(2): 99-102.
40. Srivastava P, Russo J, Russo IH. Chorionic gonadotropin inhibits rat mammary carcinogenesis through activation of programmed cell death. Carcinogenesis, 1997; 18(9): 1799-808.
41. Dewi DC, Sudiana IK. Effect of Cayratia trifolia L (Domin) Extract on Reduced Expression of Matrix Metalloproteinase-9 (Mmp–9) and Vascular Endothelial Growth Factor–A (Vegf-A) in White Rats with Breast Cancer. Folia Medica Indonesiana, 2017; 52(1): 35-41.
42. Rueda LM, Patel KJ, Axtell RC, Stinner RE. Temperature-dependent development and survival rates of Culex quinquefasciatus and Aedes aegypti (Diptera: Culicidae). Journal of medical entomology, 1990; 27(5): 892-8.
43. Deshpande PK, Gothalwal R, Pathak AK. Phytochemical analysis and evaluation of antimalarial activity of Azadirachta indica. The Pharma Innovation, 2014; 3(9, Part A): 12.
44. Chakraborty S, Singha S, Bhattacharya K, Chandra G. Control of human filarial vector, Culex quinquefasciatus Say 1823 (Diptera: Culicidae) through bioactive fraction of Cayratia trifolia leaf. Asian Pacific journal of tropical biomedicine, 2013; 3(12): 980-4.