IJPSR (2023), Volume 14, Issue 3 (Research Article)

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 14 July 2022; received in revised form, 19 August 2022; accepted 01 September 2022; published 01 March 2023

PHARMACOGNOSTICAL EVALUATION AND ANTIOXIDANT EFFECT OF SELECTED INDIAN MEDICINAL PLANTS

Sarita Chaurasia [*1], Saroj Yadav [1] and P Mani Chandrika [2]

School of Pharmacy [1], Sharda University, Greater Noida - 201306, Uttar Pradesh, India.
Department of Pharmacy [2], Bojjam Narasimhulu Pharmacy College for Women, Hyderabad - 500049, Telangana, India.

Keywords:

Ficus religiosa, *Tinospora cordifolia*, *Moringa olifera*, *Boerhaevia diffusa*, Physicochemical Parameters, Phytochemical Screening, Traditional Medicine

Correspondence to Author:
Sarita Chaurasia

Research Scholar,
School of Pharmacy,
Sharda University, Greater Noida - 201306, Uttar Pradesh, India.

E-mail: scpharma81@gmail.com

ABSTRACT: Since ancient times, herbal medicines have been utilized globally to prevent and cure a wide range of medical disorders. Despite the fact that they are employed in many different medical systems, it remains a challenge to ensure their quality control, proper scientific validation and standardization. Systematic validation and scientific regulation of natural formulations are required for the future improvement of traditional systems of medicine. The herbal products produced with proper standardization and validation are often more efficient and have fewer adverse effects. In the present study, the stem bark of *Ficus religiosa*, stems of *Tinospora cordifolia*, leaves of *Moringa olifera* and roots of *Boerhaevia diffusa* have been selected. Due to pharmacological effects present in these plants, they are widely used in different traditional medicines. All the chosen plants are standardized by powder microscopy, physicochemical parameters, phytochemical screening, heavy metal testing *etc*. Comparative analysis of these parameters helped detect adulteration in each of these selected plants. Further, the comparative study of *in-vitro* antioxidant profiles of all these selected plants helped develop the herbal formulation for treating diseased conditions.

INTRODUCTION: The environment in which we live, is going to govern the health of people. For the good health of people, they want healthy surroundings and a good health care system that should be cost-effective and available to everyone. Advancements in the modern health care system have discovered several synthetic medicines which have helped a lot in diagnosing, preventing and treating different diseases [1, 2].

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.14(3).1330-38

This article can be accessed online on www.ijpsr.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.14(3).1330-38

These synthetic drugs can produce life-threatening side effects if given in a high dose or used for a long duration [3, 4]. Globally, the population is shifting towards traditional medicine systems like Ayurveda, Siddha, Unani, Homeopathy, *etc*. Traditional medicines were the backbone for treating diseases in India during ancient times before allopathic medicines were introduced [5].

In several surveys conducted by different organizations in developing countries, around 80% of the population relies on herbal products for healthy living. A large proportion of the worldwide medicine market is based on herbal medicines, which are utilized as over-the-counter products, raw materials for pharmaceuticals and own-

prescribed formulations of plant origin [6, 7]. Despite this, the main disadvantage of herbal products is their inconsistent and variable pharmacological effects. Consequently, herbal products could only be designed as rational drugs per their quality parameters. To obtain consistent pharmacological effects, toxic effects, and clinical results, their constituents need to be well documented [9, 10]. In the present study, a few Indian medicinal plants are selected to study quality parameters for standardization. All these plants are used in different herbal formulations due to their various therapeutic effects in traditional or folk medicines. The selected plants and parts are the stem bark of *Ficus religiosa*, the stem of *Tinospora cordifolia*, the leaves of *Moringa olifera*, and the roots of *Boerhaevia diffusa* [11].

Ficus religiosa Linn. (Moraceae) is called "Pipal tree" in Hindi. It is considered a religious tree for communities like Hindus, Buddhists, *etc*. This plant is mentioned as "Asvattha" in Ayurveda. It has medicinal value in the Indian traditional and folk medicine system [12, 14]. *Tinospora cordifolia* (Menispermaceae) called "Giloy" in Hindi, is a perennial climber shrub. It is abundantly found in India, Sri Lanka, China and Myanmar [16]. It is termed as "Rasayana" due to its significant use in traditional medicine [17].

Moringa oleifera (Moringaceae) is widely distributed throughout the world [18]. Almost every part of the plant has been used for various diseases in the traditional medicine system of South Asia [19]. *Boerhaavia diffusa* Linn (Nyctaginaceae), is known as Punarnava in Sanskrit and Hogweed in English. It is native to India and a perennial creeping weed or ascending herb [20].

Morphological Characters and Phyto-constituents: The bark of *Ficus religiosa* is flat or slightly curved; the outer bark is greyish or ash-colored, exfoliated with irregularly rounded flakes of 2–2.5cm thickness. The bark is odorless, and its taste is astringent. The bark contains phytosterols like lanosterol, β-sitosterol, glucoside (β-sitosteryl-d-glucoside), and stigmasterol. The bark of *Ficus religiosa* comprises around 8.7% of the total tannin content, and other phytoconstituents are vitamin K1, n-octacosanol, methyl oleonate and lupen-3-one. Bergapten and Bergaptol are substituted furanocoumarins [21, 22]. The stem of *Tinospora cordifolia* is filiform and climbs in nature [23]. The powder of the stem is light brown or greenish brown in color with a characteristic smell and bitter taste. The chemical constituents of stem belong to different classes like alkaloids, glycosides, steroids, phenolics, aliphatic compounds and polysaccharide [24, 25]. The phytoconstituents isolated from the stem are cordifolioside A & B, berberine, 1,2-Substituted pyrrolidine, amritoside A, B, C and D, octacosanol, *etc*. [26, 28]. The leaves of *Moringa olifera* are pale green in color, compound, and alternate with a characteristic odor and bitter taste [29]. Leaves are rich in vitamins, carotenoids, flavonoids, and polyphenols. It contains phytoconstituents like kaempferitrin, isoquercetin, rhamnetin, kaempferol and quercetin, zeatin, ascorbic acid, phenolic, flavonoids, vitamin E [30, 33].

The roots of *Boerhaevia diffusa* are cylindrical, light brown with a rough surface [34]. It contains boeravinones A-1, B-1, C-2, D, E and F, behenic acid, beta-sitosterol, boerhaavicacid, borhavine, borhavone, campesterol, daucosterol, beta-ecdysone, hentriacontane N, hypoxanthine-9-l-arabinofuranoside, ursolic acid and 5,7-dihydroxy-3,4-dimethyoxy-6,8-dimethyl flavones [35].

Traditional uses of Selected Plants: In traditional medicine system, *Ficus religiosa* stem bark extract is used to treat pain, neurodegeneration, ulcer, hepatic disorders, kidney disorders, diarrhoea, different microbial infections, diabetes, and other conditions. This extract also has antiseptic and astringent properties [36, 38]. In the ayurvedic medicine system, *Tinospora cordifolia* is used to treat several diseases like jaundice, weakness, blood disorders, fever, viral hepatitis, inflammation, microbial diseases, dyspepsia, urinary diseases, skin diseases, allergic conditions, diabetes, *etc*. It is also used as an anticancer, antistress, and immunomodulator [39, 42]. *Moringa oleifera* possesses several pharmacological activities such as analgesic, antifungal, antibacterial, antihypertensive and antispasmodic, antioxidant properties, anti-hyperlipidemic and anti-atherosclerotic, anticancer, anti-anxiety, antipyretic and wound healing [43, 47]. *Boerhaevia diffusa* rejuvenates the liver and male reproductive system, cleanses the kidneys, and helps to get rid of renal calculi. Roots are used as an

immunomodulator, hepatoprotective, antidiabetic, antibacterial, antistress, antiaging, anticancer, antimalarial, and anticonvulsant [48, 53].

MATERIAL AND METHODS:

Plant Materials: In the present study, all the selected parts, such as the stem bark of *Ficus religiosa*, the stem of *Tinospora cordifolia,* and root of *Boerhaevia diffusa,* were collected from the surrounding areas of the Nagore district of Rajasthan in June. Leaves of *Moringa olifera* were collected from surrounding areas of Hyderabad. All the selected parts were authenticated by Dr. Md. Mustafa, Botanist, Department of Botany, Kakatiya University, Warangal, Telangana (Accession no. 1092, 1094, 1096, 1098).

Preparation of Plant Extracts: Dried parts of selected plants were powdered by using a mechanical grinder. The powders were passed through mesh sieve 44 and stored in airtight containers. The powdered sample was defatted with petroleum ether and kept for 72 hours at room temperature. 100 gm of each dried powdered sample was extracted with ethanol and distilled water (70:30) using the Soxhlet Apparatus for 24 hours. The solvent was removed to get the solid extract. The percentage yield of extracts for *Ficus religiosa* (4.75%), *Tinospora cordifolia* (5.67%), *Boerhaevia diffusa* (4.62%) and *Moringa oilfera* (7.54%).

Standardization of Selected Medicinal Plants: Microscopy was performed to identify the microscopic characteristics of all selected plants in crude powdered form. Physicochemical parameters like ash value, loss on drying (moisture content), acid insoluble ash, water-soluble extractive and alcohol soluble extractive were carried out for all of the selected plants as per WHO guidelines [54]. The hydroalcoholic extracts of all the selected plants were subjected to phytochemical screening to identify phytoconstituents like carbohydrates, proteins, alkaloids, tannins and phenolic compounds, saponins, and glycoside [55, 57]. Analysis of heavy metal as lead, arsenic, cadmium, mercury and chromium were analyzed in powder form of all the selected plants using Inductively Coupled Plasma- Optical Emission Spectroscopy (ICP-OES) [58, 59].

Determination of *In-vitro* Antioxidant Activity: *In-vitro*, the antioxidant activity of hydroalcoholic extracts of all selected plants was determined by DPPH free radical scavenging. A 0.25-millimolar methanolic solution of DPPH (2, 2-Diphenyl-2-picrylhydrazyl) was prepared. 1.0ml of methanolic DPPH solution was added to 1.0ml of hydroalcoholic extract in methanol, consisting of 0.01-0.0.5mg of the extract. The reaction mixture was shaken well and kept in the dark place at room temperature for 10 minutes. The absorbance of the mixture was measured at 517 nm using a double beam UV–Visible spectrophotometer. The same procedure was followed with ascorbic acid, which was used as a reference. All tests and reference standards were done in triplicates [60, 63].

The average result obtained was used for the calculation of DPPH free radical scavenging ability (%) by using the formula:

$$\text{DPPH radical scavenging activity (\%)} = \text{Abs}_{con} - \text{Abs}_{sample} / \text{Abs}_{con} \times 100$$

Where, Abs control is the absorbance of DPPH radical +methanol. Abs sample is the absorbance of DPPH radical +extract/sample.

The antioxidant effects of each extract were expressed in terms of IC_{50} (micromolar concentration required to inhibit DPPH radical formation by 50%), calculated from the graph after plotting the percentage DPPH inhibition versus extract concentration.

RESULTS AND DISCUSSION: The present study focuses on quality control parameters such as powder microscopy, physicochemical parameters, and heavy metal testing. Preliminary phytochemical screening and *in-vitro* antioxidant studies were performed with the selected plants' hydroalcoholic extracts. Powder microscopy of stem bark of *Ficus religiosa* showed sclereid, stone cells, cork cells, fibre and latex cells **Fig. 1**. Stem *Tinospora cordifolia* showed tracheids, cork cells, phloem fibre, starch grains **Fig. 2**. Leaves of *Moringa olifera* showed epidermis cells with stomata, fibres, pitted vessels and starch grains **Fig. 3**. Roots of *Boerhaevia diffusa* cork cells showed pitted vessels and starch grains **Fig. 4.**

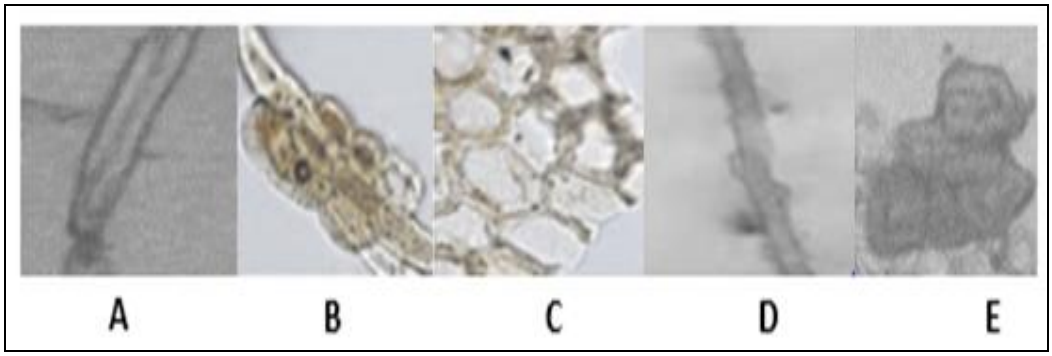

FIG. 1: MICROSCOPICAL CHARACTERS OF STEM BARK OF *FICUS RELIGIOSA*. A- SCLEREID, B- STONE CELLS, C- CORK CELLS, D-FIBRE, E-LATEX CELLS

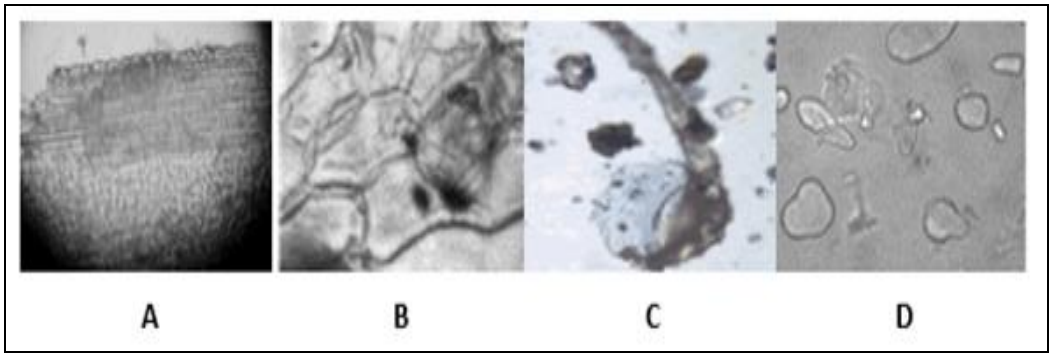

FIG. 2: MICROSCOPICAL CHARACTERS OF STEM OF *TINOSPORA CORDIFOLIA*. A- TRACHEIDS, B- CORK CELLS, C- PHLOEM FIBRE, D- STARCH GRAINS

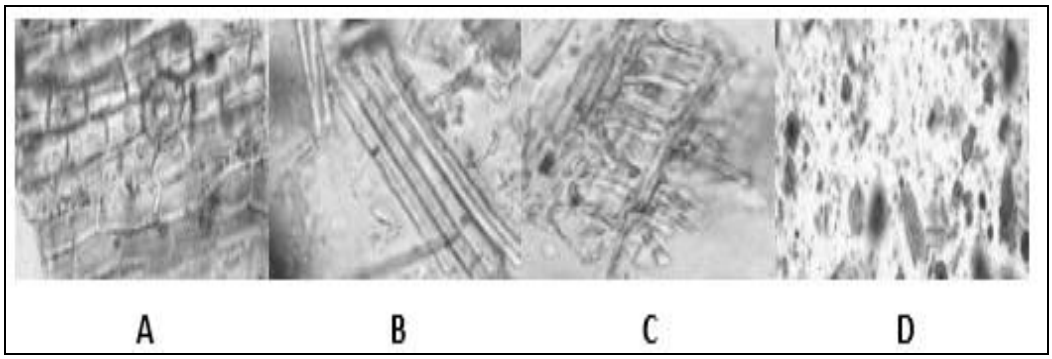

FIG. 3: MICROSCOPICAL CHARACTERS OF LEAVES OF MORINGA OLIFERA. A- EPIDERMIS CELLS WITH STOMATA, B- FIBRES, C- PITTED VESSELS, D- STARCH GRAINS

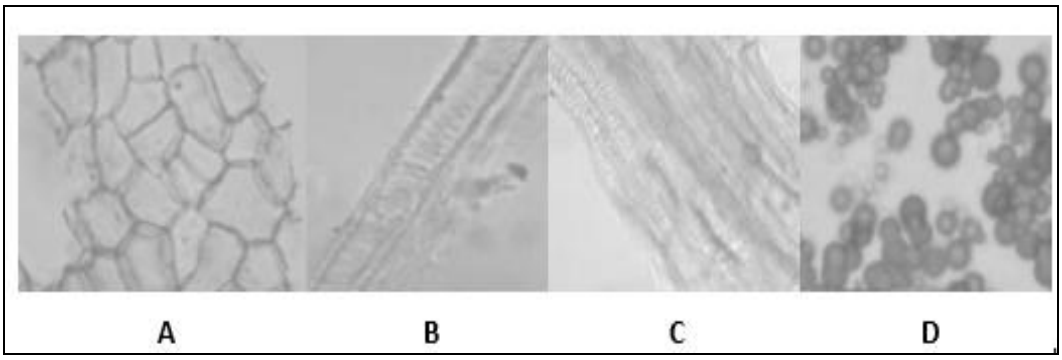

FIG. 4: MICROSCOPICAL CHARACTERS OF ROOT OF *BOERHAEVIA DIFFUSA*. A- CORK CELLS, B AND C- PITTED VESSELS, D-STARCH GRAINS

The results of various preliminary phytochemical screenings of hydroalcoholic extracts of selected plants are shown in **Table 1**. All the extracts showed the presence of phytoconstituents like alkaloids, proteins, carbohydrates, tannins, phenols, saponins, glycosides and steroids.

TABLE 1: RESULTS OF PRELIMINARY PHYTOCHEMICAL SCREENING OF THE HYDROALCOHOLIC EXTRACT OF SELECTED PLANTS

S. no.	Plant Constituents (Test / Reagent)	*Ficus religiosa*	*Tinospora cordifolia*	*Moringa olifera*	*Boerhaevia diffusa*
	Alkaloids				
1	Mayer's reagent	+	+	+	+
	Dragendroff's reagent	+	+	+	+
	Wagner's reagent	+	+	+	+
	Glycosides				
2	Killer-Killani test	+	+	+	+
	Borntrager test	+	+	+	+
	Carbohydrates				
3	Molisch's reagent	+	+	+	+
	Fehling solution	+	+	+	+
	Sterols				
4	Salkowski test	+	+	+	+
	Phenolic Compounds & Tannins				
5	Ferric chloride test	+	+	+	+
	Lead acetate solution	+	+	+	+
	Proteins & Amino Acids				
6	Biuret test	+	+	+	+
	Ninhydrin Test	+	+	+	+
	Flavanoids				
7	Ammonia test	+	+	+	+
	Saponins				
8	Foam test	+	+	+	+
	Sodium bicarbonate test	+	+	+	+

The various physicochemical parameters of powders were performed as per the Ayurvedic Indian Pharmacopoeia of India, and the results are given in **Table 2**. The values of all parameters for the selected medicinal plants were within the range of the standard limit [64].

TABLE 2: RESULTS OF PHYSICOCHEMICAL PARAMETERS OF SELECTED PLANTS

Physicochemical Parameter	% in *Ficus religiosa* Stem Bark Powder	% in *Tinospora cordifolia* Stem Powder	% in *Moringa olifera* Leaves powder	% in *Boerhaevia diffusa* Root Powder
Loss on drying	3.94%	2.65%	2.8%	2.06%
Total Ash	6.30%	11.22%	4.04%	10.9%
Acid insoluble ash	0.24%	2.16%	2.4%	1.68%
Water-soluble extractive	8.24%	9.02%	7.63%	11.96%
Alcohol soluble extractive	6.8%	2.98%	9.34%	2.46%

Heavy metal testing was done on the crude powdered form of all the selected parts of different plants by using Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES) and the results are given in **Table 3**. Except for chromium, the concentration of all the tested heavy metals was below 1 ppm per kg of crude powdered drug. The concentration of it was 1.82 ppm in the stem bark of *Ficus religiosa*, 2.96 ppm in the stem of *Tinospora cordifolia*, 1.42 in the leaves of *Moringa olifera* and 2.24 in the root of *Boerhaevia diffusa*. The maximum concentration of chromium was present in the powder of the stem of *Tinospora cordifolia.*

TABLE 3: RESULTS OF HEAVY METAL ANALYSIS OF SELECTED PLANTS

S. no.	Parameters	Results (ppm/ Kg)			
		Ficus religiosa	*Tinospora cordifolia*	*Moringa olifera*	*Boerhaevia diffusa*
1.	Lead as Pb	<1.00	<1.00	<1.00	<1.00
2.	Arsenic as As	<1.00	<1.00	<1.00	<1.00
3.	Cadmium as Cd	<1.00	<1.00	<1.00	<1.00
4.	Mercury as Hg	<1.00	<1.00	<1.00	<1.00
5.	Chromium as Cr	1.82	2.96	1.42	2.24

The percentage of DPPH inhibition of hydroalcoholic extract of all the selected plants was compared with ascorbic acid as the standard is given in **Table 4** and **Fig. 5**. All the hydroalcoholic extracts showed lesser DPPH free radical scavenging effect than ascorbic acid. The maximum antioxidant effect was shown by the hydroalcoholic extract of the stem of *Tinospora cordifolia*. DPPH free radical scavenging activity has been considered dueto the redox reaction of the extract's phytoconstituents, which helps neutralize free radicals. The IC_{50} value (micromolar concentration required to inhibit DPPH radical formation by 50%) is the minimum for ascorbic acid (standard). In **Fig. 6**, IC_{50} value for the extracts of the selected plants is given, and the value is minimum for the hydroalcoholic extract of the stem of *Tinospora cordifolia.*

TABLE 4: % DPPH INHIBITION OF HYDROALCOHOLIC EXTRACT OF SELECTED PLANTS AND ASCORBIC ACID

Concentration (mcg/ml)	% DPPH Inhibition of Different of Hydroalcoholic Extract (mean±S.D.)				
	Ficus religiosa	*Tinospora cordifolia*	*Moringa olifera*	*Boerhaevia diffusa*	*Ascorbic acid*
10	26.84 ± 0.001	44.58± 0.001	31.53± 0.003	38.35± 0.002	54.62± 0.001
20	39.89± 0.001	56.56± 0.002	37.35± 0.002	44.58± 0.001	68.07± 0.001
30	48.93± 0.001	58.77± 0.003	42.77± 0.002	51.00± 0.001	83.33± 0.001
40	57.01± 0.001	62.78± 0.001	50.40± 0.002	55.62± 0.002	87.55± 0.001
50	62.12± 0.002	68.87± 0.001	56.43± 0.001	59.24± 0.002	91.97± 0.001

Mean= Average of three absorbances, S.D. =Standard deviation.

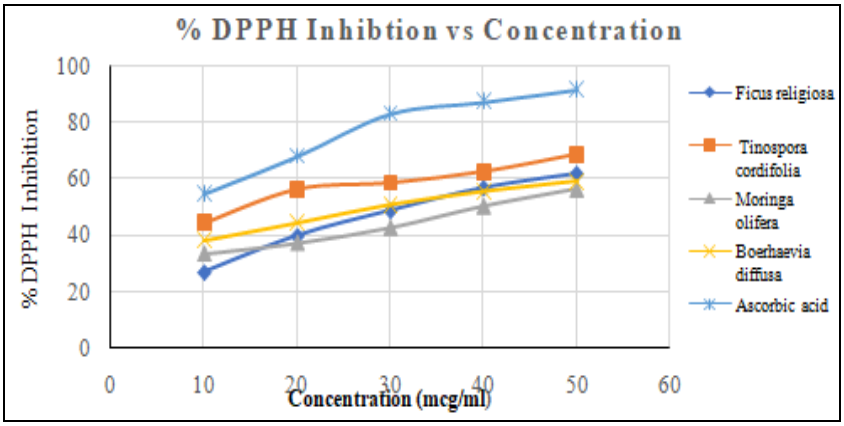

FIG. 5: COMPARATIVE DPPH % INHIBITION OF HYDROALCOHOLIC EXTRACTS OF SELECTED PLANTS AND ASCORBIC ACID

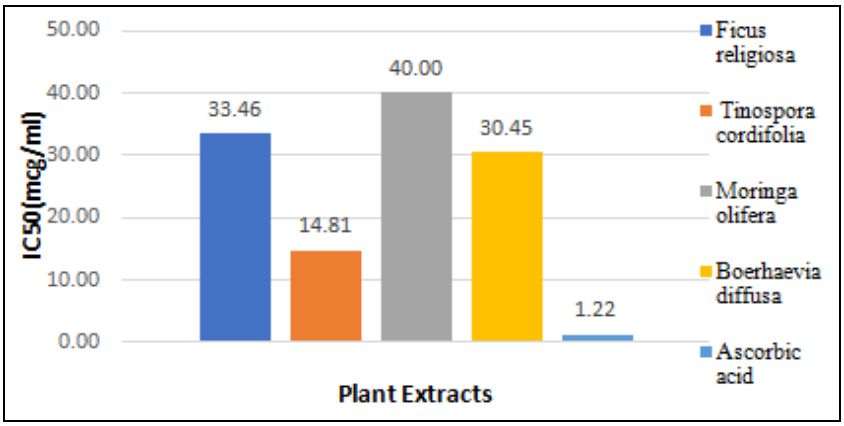

FIG. 6: IC 50 VALUES OF ASCORBIC ACID OTHER PLANT EXTRACTS

Standardization ensures that every medicine or herbal product on the market contains the same constituent and has the same pharmacological effect. Powder microscopy, physicochemical parameters, phytochemical screening, and heavy metal testing were used to investigate the quality control parameters of the selected medicinal plant materials.

This scientific validation is useful for assessing quality, adulteration, purity, and uniformity in the phytoconstituents of the selected medicinal plants. All the selected plants showed good DPPH free radical scavenging activity.

They could be used to develop an herbal formulation for treating diseases associated with a high level of free radicals. The IC_{50} value is the minimum for the hydroalcoholic extract of the stem of *Tinospora cordifolia*, but it is more than IC_{50} value of ascorbic acid. The potential pharmacological utility of all these selected medicinal plant parts would be benefited from a further study on these standardized medicinal plants.

ACKNOWLEDGEMENT: Authors acknowledge the recognition of the University to provide the facility to carry out this work. The authors also want to acknowledge Lucid Laboratories, Hyderabad, for performing heavy metal testing.

CONFLICTS OF INTEREST: The authors declare no conflict of interest.

REFERENCES:

1. Cragg GM and Newman DJ: Natural Products as Sources of New Drugs over the Nearly Four Decades from 01/1981 to 09/2019. Journal of Natural Products 2020; 83(3): 770-803.
2. Jaiswal YS and Williams LL: A glimpse of Ayurveda e The forgotten history and principles of Indian traditional medicine. Journal of Traditional and Complementary Medicine 2017; 7: 50-53.
3. Sen S and Chakraborty R: Revival, modernization and integration of Indian traditional herbal medicine in clinical practice: Importance, challenges and future. Journal of Traditional and Complementary Medicine 2017; 7(2): 234-244.
4. Shi Y, Zhang C and Li X: Traditional medicine in India. Journal of Traditional Chinese Medical Sciences 2021; 8: 52-55.
5. Dubey NK: Global promotion of herbal medicine: India's opportunities. Asia Pacific Journal of Traditional Medicine 2017; 13(2): 4-5.
6. Prasathkumar M, Anisha S, Dhrisya C, Becky R and Sadhasivam S: Therapeutic and pharmacological efficacy of selective Indian medicinal plants – A review. Phytomedicine Plus 2021; 1(2): 1-28.
7. Sivakrishnan S: Traditional Herbal Medicines – A Review. International Journal of Research and Analytical Reviews 2018; 5 (4): 611-614.
8. Karbwang J, Francis P, Na-Bangchang K and Maramba-Lazarte C: Herbal medicine development: methodologies, challenges, and issues. Evidence-Based Complementary and Alternative Medicine 2019; 1-2.
9. Bhusnure OG, Suryawanshi S, Vijayendra Swamy SM, Gholve SB and Girm PS: Standardization and Quality Evaluation of Herbal Drugs Journal of Drug Delivery and Therapeutics 2019; 9(3): 1052-1062.
10. Dwivedi T, Kanta C, Singh LR and Sharma IP: A list of some important medicinal plants with their medicinal uses from Himalayan State Uttarakhand, India. Journal of Medicinal Plants Studies 2019; 7(2): 106-116.
11. Sandeep, Kumar A, Dimple, Tomer V, Gat Y and Kumar V: *Ficus religiosa*: A wholesome medicinal tree. Journal of Pharmacognosy and Phytochemistry 2018; 7(4): 32-37.
12. Sharma V, Mishra S, Yesudas R and Rajput RS: A Review on *Ficus religiosa* (Sacred Fig). International Journal of Research and Analytical Reviews 2019; 6(2): 901-906.
13. Sharma SK and Gupta VK: *In-vitro* antioxidant studies of *Ficus racemosa* linn. root. Pharmacognosy Magazine 2021; 4(13): 70.
14. Tiwari P, Nayak P, Prusty SK and Sahu PK: Phytochemistry and Pharmacology of *Tinospora cordifolia*: A Review. Systematic Reviews in Pharmacy 2018; 9(1): 70-78.
15. Yoggeta, Bhatia D and Rani S: *Tinospora cordifolia*: A Literature Review on Therapeutic uses and Pharmacological Actions. Journal of Pharmaceutical Research International 2021; 33 (57): 330-343.
16. Meireles D, Gomes J, Lopes L, Hinzmann M and Machado J: A review of properties, nutritional and pharmaceutical applications of *Moringa oleifera*: integrative approach on conventional and traditional Asian medicine. Advances in Traditional Medicine 2020; 20: 495-515.
17. Thapa K, Poudel M and Adhikari P: *Moringa oleifera*: A Review Article on Nutritional Properties and its Prospect in the Context of Nepal. Acta Scientific Agriculture 2019; 3(11): 47-54.
18. Gour R: *Boerhaavia diffusa* Linn Plant: A Review – One Plant with Many Therapeutic Uses. International Journal of Pharmaceutical Sciences and Medicine 2021; 4: 25-41
19. Murugesu S, Selamat J and Perumal V: Phytochemistry, Pharmacological Properties, and Recent Applications of *Ficus benghalensis* and *Ficus religiosa*. Plants 2021; 10: 1-29.
20. Madeleine DT, Noel NJ, Theodore AA, Abdoulaye H and Emmanuel T: Antioxidant Activity and Chemical Constituents from Stem Bark of *Ficus abutilifolia*. Miq (Moraceae). European Journal of Medicinal Plants 2020; 31(13): 48- 59.
21. Sharma P, Dwivedee BP, Bisht D, Dash AK, Kumar D: The chemical constituents and diverse pharmacological importance of *Tinospora cordifolia*. Heliyon 2019; 5(9): 1-8.
22. Garg P and Garg R: Qualitative and quantitative analysis of leaves and stem of *Tinospora cordifolia* in different solvent extract. Journal of Drug Delivery and Therapeutics 2018; 8(5): 259-64.
23. Singh D and Chaudhuri PK: Chemistry and Pharmacology of *Tinospora cordifolia*. Natural Product Communications 2017; 12 (2): 300-308.
24. Philip S, Tom G and Vasumathi AV: Evaluation of the anti-inflammatory activity of *Tinospora cordifolia* (Wild.) Miers chloroform extract- a preclinical study. Journal of Pharmacy and Pharmacology 2018; 70 (8): 1113-1125.
25. Abhijeet R and Mokat D: On vegetative propagation through stem cuttings in medicinally lucrative *Tinospora species*. Journal of Pharmacognosy and Phytochemistry. 2018; 2: 2313-2318.
26. Sumran G and Aggarwal A: Prospect of Indian herbs as sources of antioxidants incombating oxidative stress. J of Chemical and Biological Interfaces 2019; 9: 1-20.

27. Fidrianny I, Kanapa I and Singgih M: Phytochemistry and Pharmacology of Moringa Tree: An Overview. Biointerface Research in Applied Chemistry 2021; 11(3): 10776 - 10789
28. Rani, NZA, Hussain K and Kumolosasi E: Moringa Genus: A Review of Phytochemistry and Pharmacology. Frontiers in Pharmacology 2018; 1-26.
29. Shukla P and Tripathi M: Pharmacognostical Evaluation and Antimicrobial activity of *Moringa oleifera* Lamk. Leaf. International Journal of Pure and Applied Bioscience 2015; 3(5): 95-100.
30. Vergara-Jimenez M, Almatrafi MM, Fernandez ML: Bioactive Components in Moringa Oleifera Leaves Protect against Chronic Disease. Antioxidants 2017; 6: 91.
31. Gothai S, Muniandy K, Zarin MA and Sean TW: Chemical Composition of *Moringa oleifera* Ethyl Acetate Fraction and Its Biological Activity in Diabetic Human Dermal Fibroblasts, Pharmacognosy Magazine 2017; 462-469.
32. Kaur H: *Boerhaevia diffusa*: Bioactive Compounds and Pharmacological Activities. Biomedical & Pharmacology Journal 2019; 12(4): 1675-1682
33. Sharma K and Sahai M: Chemical constituents of *Boerhavia diffusa* leaves. Journal of Medicinal Plants Studies 2017; 5(4): 166-169.
34. Al-Snafi PDAE: Pharmacology of *Ficus religiosa*- A review. IOSR Journal of Pharmacy 2017; 07(03): 49-6.
35. Goyal AK: Phytochemical and Medical Properties of *Ficus religiosa* Specific Parts Extracts: A Review. International Journal of Pharmacy & Life Sciences 2014; 5(4): 3424-3429
36. Hashmi N, Muhammad F and Javed I: Nephroprotective effects of *Ficus religiosa* Linn (peepal plant) stem bark against isoniazid and rifampicin induced nephrotoxicity in albino rabbits. Pakistan Veterinary Journal 2013; 33(3): 330-334.
37. Sharma B, Duttb V, Kaurb N, Mittalb A and Dabura R: *Tinospora cordifolia* protects from skeletal muscle atrophy by alleviating oxidative stress and inflammation induced by sciatic denervation. Journal of Ethnopharmacology 2020; 254: 112720.
38. Nair A, Chattopadhay D and Saha B: Plant-Derived Immunomodulators. New Look to Phytomedicine London: Academic Press 2019; 435-499.
39. Bharati C, Reddy AH, Nageswari G, Lakshmi BS and Venkatappa B: A review on medicinal properties of *Tinospora cordifolia*. International Journal of Scientific Research and Review 2018; 7(12): 585-98.
40. Antul K, Amandeep P, Gurwinder S and Anuj C: Review on Pharmacological Profile of Medicinal Vine: *Tinospora cordifolia*. Current Journal of Applied Science and Technology 2019; 35: 1-11.
41. Prajwala B, Raghu N, Gopinath and Basalingappa KM: Guduchi: Its medicinal properties. Journal of Plant Physiology and Pathology 2019; 7(3): 1-6.
42. Priyanka G: A review on therapeutic multipurpose medicinal use of *Tinospora cordifolia*. International Journal of Trend in Scientific Research and Development 2019; 3(5): 2115-19.
43. Singh L, Singh J and Singh J: Medicinal and Nutritional Values of Drumstick Tree (*Moringa oleifera* - A Review. International Journal of Current Microbiology and Applied Sciences 2019; 8(5): 1965-1974.
44. Singh A and Navneet: Ethnomedicinal, Pharmacological and Antimicrobial Aspects of *Moringa oleifera* Lam. A review. The Journal of Phytopharmacology 2018; 7(1): 45-50.
45. Bhattacharya A, Sahu PK, Kumar S: A Review of the Phytochemical and Pharmacological Characteristics of *Moringa oleifera*. Journal of Pharmacy and Bioallied Sciences 2018; 10(4): 181–191.
46. Paikra BK, Dhongade HKJ and Gidwani B: Phytochemistry and Pharmacology of *Moringa oleifera* Lam. Journal of Pharmacopuncture 2017; 20(3): 194-200.
47. Brilhante RSN, Sales JA and Pereira VS: Research advances on the multiple uses of **Moringa oleifera**: A sustainable alternative for socially neglected population. Asian Pacific Journal of Tropical Medicine 2017; 10(7): 621–630.
48. Sachinthi S. Amarasiria, Attanayakeb AP, Liyanagae DAM and Arawwawalac: Protective effects of three selected standardized medicinal plant extracts used in Sri Lankan traditional medicine in adriamycin induced nephrotoxic Wistar rats. Journal of Ethnopharmacology 2020; 259: 112933.
49. Biradar SP, Tamboli AS, Khandare RV and Pawar PK: Chebulinic acid and Boeravinone B act as anti-aging. and anti-apoptosis phyto-molecules during oxidative stress. Mitochondrion 2019; 46: 236-246.
50. Alam P, Shahzad N, Gupta AK, Mahfoz AM, Bamagous SS, et.al.: Anti-diabetic Effect of *Boerhavia diffusa* L. Root Extract via Free Radical Scavenging and Antioxidant Mechanism. Toxicology and Environmental Health Sciences 2018; 10: 220-227.
51. Kumar R, Gautam S, Singh KD, Kumar P, Haque N and Yadav V: Pharmacological properties of Boerhavia diffusa: A review. International Journal of Chemical Studies 2018; 4: 72-80.
52. Kapil S. Patil and Sanjivani R. Bhalsing: Ethnomedicinal uses, phytochemistry and pharmacological properties of the genus Boerhavia. Journal of Ethnopharmacology 2016; 182: 200–220.
53. Adefokun DI, Iwalewa EO and Omisore NO: The Antimalarial Effect and Mechanism of Action of Methanolic Root Extract of *Boerhavia diffusa* in Mice. British Journal of Pharmaceutical Research 2015; 8: 1-14.
54. World Health Organization. WHO Monographs on selected medicinal plants: 2003.
55. Laveena KB and Chandra M: Qualitative phytochemical screening of selected medicinal plants of *Dakshina kannada* district. International Journal of Advanced Research 2020; 8(09): 506-511.
56. Evans WC: Trease. Pharmacognosy. 16th Edition. London: WB Sacenders Company Ltd 2009.
57. Kokate CK, Purohit AP, Gokhale SB, Pharmacognosy. Ed 38th Pune India: Nirali Prakashan 2016; 34.
58. Vaikosen EN and Alade GO: Determination of heavy metals in medicinal plants from the wild and cultivated garden in Wilberforce Island. Journal of Pharmacy & Pharmacognosy Research 2017; 5(2): 129-143.
59. Helaluddin ABM, Khalid RS and Alaama M: Main Analytical Techniques Used for Elemental Analysis in Various Matrices. Tropical Journal of Pharmaceutical Research 2016; 15(2): 427-434.
60. Brand-Williams W, Cuvelier ME and Berset C: Use of a free radical method to evaluate antioxidant effect, Lebensmittel-Wissenschaft and Technologie 1995; 28: 25.
61. Blois MS: Antioxidant determinations by the use of stable free radical. Nature 1958; 181: 1199-200.
62. Lalhminghlui K and Jagetia GC: Evaluation of the free-radical scavenging and antioxidant activities of Chilauni, *Schimawallichii Korth in-vitro*. Future Science OA 2018; 4(2): FSO272.

63. Szerlauth A, Muráth S, Viski S and Szilagyi I: Radical scavenging activity of plant extracts from improved processing. Heliyon 2019; 5(11): 1-5.

64. The Ayurvedic Pharmacopoeia of India, First Edition, Government of India Ministry of Health And Family Welfare Department of Ayush New Delhi 2016.

How to cite this article:
Chaurasia S, Yadav S and Chandrika PM: Pharmacognostical evaluation and antioxidant effect of selected Indian medicinal plants. Int J Pharm Sci & Res 2023; 14(3): 1330-38. doi: 10.13040/IJPSR.0975-8232.14(3).1330-38.