

Phytochemical analysis and antioxidant study of methanolic extract of leaves of *Ficus religiosa* Linn.

Dr. Bhawana Sati

Faculty of Department of Pharmaceutical Chemistry
Banasthali Vidyapith, Jaipur, Rajasthan, Pin. –304022, India.

Dr. Nilip Kanti Deb

Professor, Academic Director,
Global College of Pharmaceutical Technology, Kolkata, West Bengal, Pin. - 741102, India.

Soumya Saha*

Faculty of Department of Pharmaceutical Chemistry
Netaji Subhas Chandra Bose Institute of Pharmacy, Chakdaha, Nadia, West Bengal, Pin. –741222, India.

Abstract

Ficus religiosa L. (Moraceae), commonly known as “Peepal” is an evergreen, perennial, ornamental tree. According to the Indian art and literature it can be said that the 'Tree of Life' of the Indian subcontinent. References to *Ficus religiosa* are found in several ancient holy texts like Artha sastra, Puranas, Upanishads, Ramayana, Mahabharata. *Ficus religiosa* is endemic to the Asia-Tropical regions with an average life ranging between 900–1,500 years. Traditionally, the leaves are used to treat sexual disorders, diarrhea, haematuria, toothache, migraine, eye troubles, gastric problems. Literature review suggests the presence of various phytoconstituents like campesterol, α -amyrin, lupeol, tannic acid, n-nonacosane, 28-isofucosterol and sitosterol for anticancer, antioxidant, antidiabetic, antimicrobial, anticonvulsant, anthelmintic, antiulcer activity.

Apart from this, diseases linked with oxidative stress, such as cancer, rheumatoid arthritis, and respiratory issues, are on the rise may be due to our irregular life style. These conditions may be treated using free radicals found in plants. The aim of the present study is therefore to determine *in vitro* antioxidant activity and also to ascertain the qualitative and quantitative estimation in the leaves extracts of *Ficus religiosa* Linn.

The plant material after authentication was dried, Powdered, defatted with petroleum ether, extracted with chloroform to remove chlorophyll and then finally with methanol as the solvent. Different qualitative and quantitative estimations including the total alkaloid, flavonoid and Phenolic content were determined followed by antioxidant activity by DPPH radical scavenging method.

Preliminary phytochemical studies confirmed the presence of alkaloids, flavonoids, tannins and steroids. The total alkaloid content in the methanolic extract was found to be 5.89 ± 1.07 mg./g. whereas total flavonoid and phenolic content were found to be 23.37 ± 0.25 mg. QE/g. and 37.35 ± 0.33 mg. GAE/g. respectively. The IC_{50} values of the methanolic leaves extract of *Ficus religiosa* and ascorbic acid were found to be 57.81 ± 0.33 μ g/ml and 46.88 ± 0.53 μ g/ml respectively. This shows that the methanolic leaves extract of *Ficus religiosa* Linn. possess strong antioxidant activity which is comparable with the standard ascorbic acid.

Key words: Bodhi Tree; colorimetric method; cold maceration; free radical; gravimetric method.

I. INTRODUCTION

Ficus religiosa Lin. belonging to the Moraceae family and generally known as "Peepal tree". It is a large, evergreen, perennial, deciduous, glabrous when young and ornamental tree [1]. The fig tree is popularly known as "Bodhi Tree". This tree is also referred to as the Tree of Life in Indian subcontinent. Ficus, which is mentioned in a number of prehistoric holy books, such as the Artha Sastra, Purana, Upanishads, Ramayana, Mahabharata, Bhagavad-Gita and many others [2]. The Latin term 'fig' meaning "the tree's fruit" is "Ficus" and the word "religiosa" means "religion", because the tree has significance in both Buddhism and Hinduism. It is indigenous to tropical Asian countries. It is ecologically dispersed throughout forests. Native to Asia-Tropical countries, this species can be found in India, Nepal, Bangladesh, China, Pakistan, Myanmar, Vietnam, Thailand and Iraq. Trees belonging to the *F. religiosa* species have a lengthy life span; on average, they may survive for 900–1,500 years [3-4]. This large, older tree is 30 meters in length and has leathery and heart-shaped leaves with long tips. The petioles of the tree are long and slender, and the fruits that grow in pairs are purple. The bark is 5-8 mm in thickness; it is either flat or slightly curved. The outer surface of the bark is grey, occasionally brownish patches of lichens are seen on the outer surface. When the leaves first grow, they have a reddish-pinkish color, but as they mature, they change to a dark green color; roughly 12-18 cm (l). They are connected to long, flexible stalks, which leads them to rustle and flutter; the foliage tends to be dense. Flowers usually red in colour appears in the month of February. Fruits are tiny, with a diameter of $\frac{1}{2}$ inch, round in shape; fruits are seen during summer season [5-6]. According to the Ayurvedic system of medicine, Charaka and Sushruta prepared Ashvatha's bark to be boiled for bleeding (hemorrhages) and leaves to cover wounds. Traditionally this plant is used for

a variety of human ailments like problems related to vision, digestion, dental aches, ear pain, headache, dysentery and sex related problems. Leaves and tender shoots have Purgative action, wounds healing properties and also treat for skin diseases; Bark decoction is used in gonorrhoea, skin diseases, scabies. The plant contains cardiac and saponin glycosides, Polyphenolic constituents, alkaloids, steroids, terpenoids and flavonoids. The Leaves contain α -amyrin, tannic acid, hexacosanol, campesterol, n-nonacosane and n-octacosane, Stigmasterol, campesterol, 28-isofucosterol and sitosterol [7]. Leaves contain a high proportion of Dietary fiber full of carbohydrates & protein. Minerals including Iron, calcium etc. are also present. The plant is used in several systems of medicine in several formulations, such as Ayurvedic, Unani, and Siddha. *F. religiosa* has antioxidant, antidiabetic, anticancer, antimicrobial, anti-inflammatory, antiulcer, antiasthmatic, properties [8-9].

According to Literature review, the constituents present in the plant exhibits various pharmacological activities. Presently diseases occurring due to Oxidative stress are on the rise due to several environmental, life style disorders, economic reasons that are affecting a larger proportion of the society. Plant possesses such potent substances that can reduce free radicals and thereby bring relief from diseases resulted from oxidative stress. The aim of current research is therefore to ascertain the antioxidant activity and to determine its total alkaloidal, phenolic, and flavonoidal content.

II. MATERIALS AND METHODS

2.1. Plant material –

The Medicinal Garden of the Netaji Subhas Chandra Bose Institute of Pharmacy at Tatla, Chakdaha, Nadia, West Bengal, India, fresh leaves of the plant *F. religiosa* Linn. were collected and authenticated by Dr. Suchandra Samanta Mandal, M.Sc. (Botany), KU, M Phil. (Education), KU, Assistant Professor, K. Bed College, Krishnanagar, West Bengal, India (Cert / 02 / 23).

2.2. Chemicals and reagents –

The chemicals, solvents, and reagents utilized in this study were of standard analytical grade, sourced from S.D. Fine Chem Ltd., Mumbai, and Loba Cheme, Mumbai.

2.3. Statistical analysis –

All experiments were conducted in triplicate, and the results are expressed as mean values $\pm$ standard deviation. Statistical analysis was performed using GraphPad Prism software [version 8.0.2 (263), 1992-2019 GraphPad Software, Inc. USA]. Mean comparisons were carried out by one-way ANOVA, followed by Tukey's t-test, with significance set at $P < 0.05$.

2.4. Pharmacognostical studies –

2.4.1. Macroscopic studies:

Macroscopic evaluation was conducted out for the newly leaves material. Organoleptic study of plants material such as color, size, odors, taste, surface feature was noticed. The results are depicted in Table1. Their identity was confirmed by comparing their macroscopic and characters reported in the literature [4, 9].

2.5. Preparation of extract –

The plant material was dried thoroughly in shade condition at room temperature. It was then subjected to size reduction. petroleum ether was used to defatten 250 grams of the plant material. The marc was thoroughly dried and subjected to cold maceration process with chloroform to remove chlorophyll (24 hrs.) and finally extracted with methanol. The methanolic extract obtained was dried at temperature below 40° C to obtain concentrate of the crude extract. The extract was stored in an appropriate container with suitable labelling inside the desiccator for later usage [10].

2.6. Phytochemical screening –

Different qualitative chemical tests were done on the methanolic extract to determine the numerous active elements that are present in the leaves of the plant *Ficus religiosa* L. Phytochemical screening was performed using standard procedures [11]. The results are depicted in Table 2.

2.7. Quantitative estimation of total alkaloid content –

The total alkaloid content was estimated by gravimetric method of Harborne. 20 gm. of powdered sample accurately weighed and placed in 250 ml. stoppered conical flask. 100 ml. of 10% acetic acid in ethanol was added and conical flask was covered properly and allowed to stand for 4 hrs. It was filtered through Whatman fine filter paper. At 60° C, the filtrate was concentrated to a quarter of its initial volume on a water bath. Concentrated aqueous ammonium hydroxide solution was added dropwise to the samples in order to precipitate the alkaloids. The precipitates were

collected and washed with 15% ammonium hydroxide solution. For half an hour, the precipitates were dried in an oven set at 60° C [12].

The following formula was used to determine the percentage of alkaloids:

$\% = W/Y \times 100$ (Where W= weight of the alkaloid extracted in grams Y= weight of the powdered drug material in grams).

Alkaloid content was calculated and expressed as percent of the weight of the sample analysed.

2.8. Quantitative estimation of total flavonoid content by colorimetric method –

The amount of flavonoid is assessed by the standard procedure mentioned by Abdel-Hameed, (2009) using quercetin as standard [13-14].

2.8.1. Estimation of total flavonoid content:

The Chang et al. (2002) method was used to determine the total flavonoid content obtained from the plant extracts. Methanol (3 ml.), aluminum chloride (0.2 ml., 10%), potassium acetate (0.2 ml., 1M.), and distilled water (5.6 ml.) were added to the plant extract (1 ml., 1000 µg./ml.). The reaction mixture was incubated at room temperature for 30 min and the absorbance was measured at 415 nm using an UV – visible spectrophotometer. Quercetin (20–100 µg./ml.) was used as standard. Using the quercetin standard plot, the total flavonoid content was determined and reported as quercetin equivalents per gram of dry weight of extract (mg. QE/g.) [15].

2.9. Quantitative estimation of total phenolic content by colorimetric method –

The total Phenolic content is determined by Folin-Ciocalteu's colorimetric method based on the procedure of (Abdel-Hameed, 2009; Alali et al., 2007) with slight modifications [13, 16-17].

2.9.1. Estimation of total phenolic contents:

Gallic acid (20–100 µg./ml.) is the standard used to estimate phenolic compounds. The plant extract (1 ml., 1000 µg./ml.), 2.25 ml. of distilled water and 1.25 ml. of 0.2 N Folin-Ciocalteu's reagent is added and after five minutes 1 ml. of saturated sodium carbonate 7.5 % w/v is added to the above mixture. The resulting blue-colored solution is incubated at 30° C for 1.5 hr. with occasionally shaking, and then measuring the absorbance at 765 nm. in UV-Spectrophotometer.

Gallic acid equivalents (GAE) in mg./g. are used to express the total phenolic content.

2.10. DPPH (1,1-Diphenyl-2-picryl-hydrazyl) free radical scavenging activity –

2.10.1. Preparation of Sample Solutions:

Methanol was used to dissolve the dry extract, that leads to a final concentration of 100 µg./ml. Using the stock solution Five volumetric flasks containing 2, 4, 6, 8, and 10 ml. of the solution were serially diluted to reach a final volume of 10 ml., with concentrations of 20, 40, 60, 80, and 100 µg./ml., respectively [18-21].

2.10.2. Preparation of Standard Solutions:

Ascorbic acid was used as a standard and dissolved in distilled water to make the stock solution with the same concentration (100 µg./ml.) of extract. The different dilutions of standard 20, 40, 60, 80, 100 µg./ml. were prepared [22-23].

2.10.3. Evaluation of DPPH Free Radical Scavenging Activity

50 µM of DPPH solution was prepared using methanol. 2 ml. of the DPPH solution was mixed with different concentrations of sample and standard solution separately (2 ml. each). For half an hour, these solution mixtures were incubated in a dark place and absorbance was measured in 517 nm. using Ultraviolet visible spectrophotometer. Methanol (2 ml.) with 2 ml. DPPH solution was used as control. A control was made with the same volume but without the standard or sample. Methanol was used as blank. The following formula was used to record the absorbance and calculate the percentage of inhibition:

$\% \text{ Inhibition} = (A_0 - A_1) / A_0 \times 100$, where A_0 is the absorbance of control solution (contains all the test reagents except the test compound) and A_1 is the absorbance of plant extracts or standard [24-25].

The IC50 value was determined by plotting concentration against percentage inhibition.

III. RESULTS AND DISCUSSION

3.1. Macroscopic characters –

Macroscopic characters of *Ficus religiosa* L. leaves shown in the following Table 1.

Table 1. Macroscopic characters of *Ficus religiosa* L. Leaves

Characters	Observation
Colour	Mature Leaf – Deep Green Tender Leaf – Rose to Light Red
Odour	Odourless
Taste	Not significant
Surface	Adaxial – glabrous, shiny Abaxial – coriaceous
Size	Length – 15 – 24 cm. Width – 7 – 18 cm. Petiole – 2 – 5 inches
Margin	Entire, leathery, tip narrowed into a long tail and half the length of the blade, rounded at the base
Arrangements	Alternate, Narrow upward
Characteristic	Deltoid lamina

3.2. Qualitative chemical tests of the extract –

The qualitative analysis indicated the presence of various secondary metabolites. The results are given in Table 2.

Table 2. Qualitative Chemical Tests of the Methanolic Extract of *Ficus religiosa* L. Leaves

Test		Methanolic Extract
Alkaloids	Dragendroff's Test	+
Amino Acids	Millon's Test	+
Carbohydrates	Molisch's Test	+
	Barfoed's Test	+
	Test for Pentoses	+
Flavonoids	Shinoda Test	+
	Zinc hydrochloride Test	+
Glycosides	General Tests	+
	Borntrager's Test	-
	Modified anthraquinones Test	+
	Froth formation Test	+
Tannins	Chlorogenic acid Test	+
	Ferric Chloride Test	+
	Gelatin Test	+

Proteins	Xanthoproteic Test	-
Steroids	Liebermann-Burchard Test	+
	Salkowski Test	+
Phenolic	Liebermann's Test:	+
	Ferric Chloride Test	+

["+" = Present and "-" = Absent]

3.3. Total alkaloid content –

Estimation was carried out by gravimetric method. The total alkaloid content was found to 5.89 ± 1.07 mg./g.

3.4. Total flavonoid content –

The total flavonoid content in plant extract was examined with the help of spectroscopic method using aluminum chloride using quercetin as standard. A calibration curve was plotted for quercetin in the concentration range of 20-100 µg./ml. The regression equation ($y = 0.0105x - 0.1552$) for the standard curve for quercetin showed an excellent coefficient of correlation ($R^2 = 0.9985$) with low intercept value. The total flavonoid content was found to be 23.37 ± 0.25 mg. QE/g.

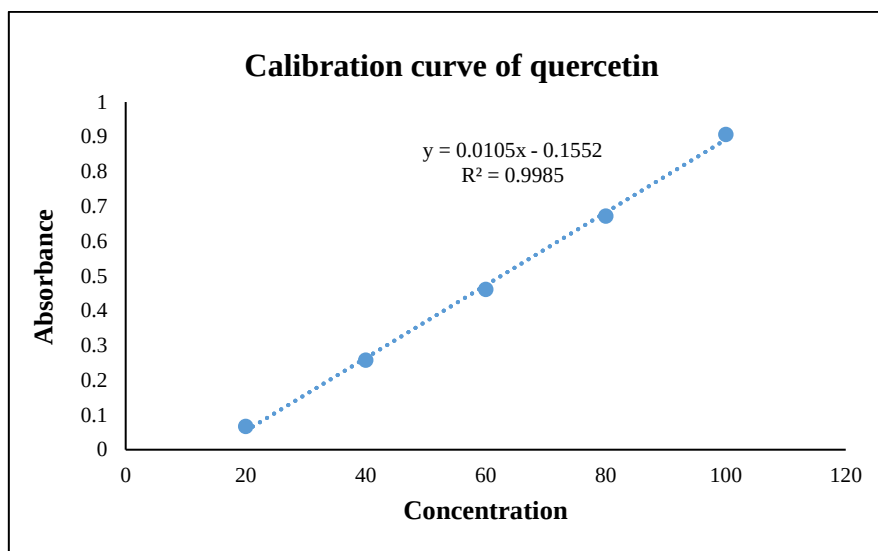


Figure 1. Calibration curve of quercetin

3.5. Total phenolic content –

The total Phenolic content in plant extract was examined by using Folin - Ciocalteu's reagent. A calibration curve was plotted for gallic acid in the concentration range of 20-100 µg./ml. The regression equation ($y = 0.0086x + 0.0175$) for the standard curve for gallic acid showed an excellent coefficient of correlation ($R^2 = 0.998$). The total Phenolic content was found to be 37.35 ± 0.33 mg. of GAE/g.

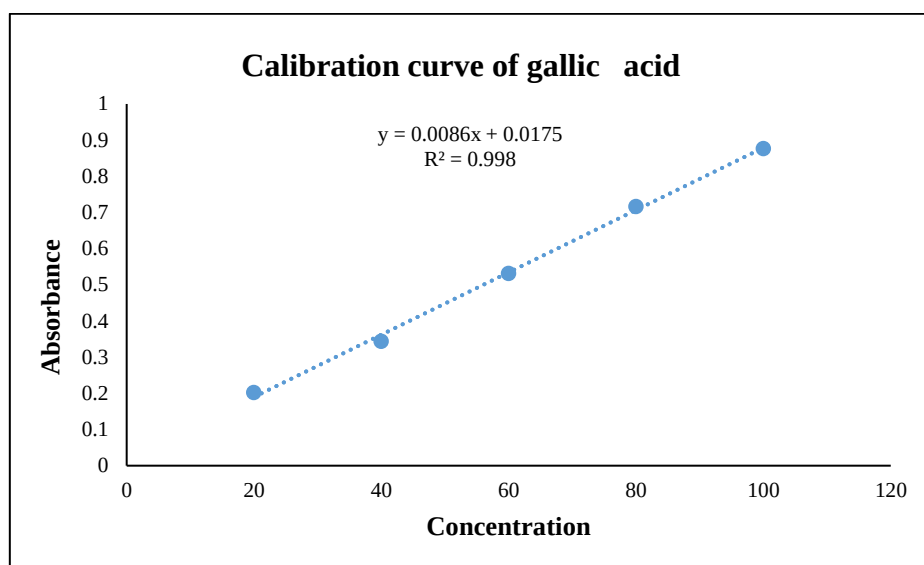


Figure 2. Calibration curve of gallic acid

Table 3. Quantitative screening of phytochemicals (alkaloids, flavonoids, phenols) in methanolic leaf extract of *Ficus religiosa* L.

Serial No.	Alkaloids mg./g. of Extract	Flavonoids mg. QE/g. of Extract	Phenols mg. GAE/g. of Extract
1.	5.89 ± 1.07	23.37 ± 0.25	37.35 ± 0.33

[The values indicate significant differences by one-way ANOVA, followed by Tukey's t-test $P < 0.05$]
[QE: Quercetin equivalent, GAE: Gallic acid equivalent]

Table 4. DPPH Radical scavenging activity of methanolic extract of *Ficus religiosa* L.

Concentration (µg./ ml.)	DPPH Radical Scavenging activity (% inhibition)	
	Methanolic Extract of <i>Ficus religiosa</i> L.	Ascorbic acid
20	29.40 ± 0.11	36.11 ± 0.33
40	40.41 ± 0.21	47.52 ± 0.57
60	50.88 ± 0.55	56.92 ± 0.63
80	62.02 ± 0.62	66.31 ± 0.78
100	73.29 ± 0.71	74.49 ± 0.89
IC ₅₀	57.81 ± 0.33	46.88 ± 0.53

[The values indicate significant differences by one-way ANOVA, followed by Tukey's t-test $P < 0.05$]

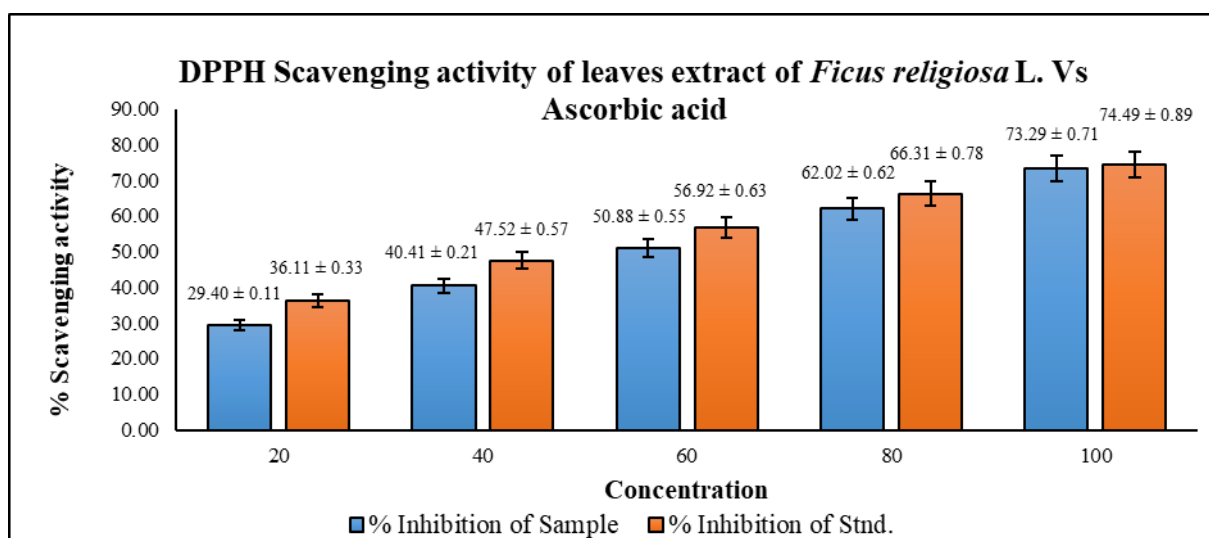


Figure 3. Percentage of inhibition in various concentration of leaves extract of *Ficus religiosa* L. Vs Ascorbic acid. The values indicate significant differences by one-way ANOVA, followed by Tukey's t-test $P < 0.05$

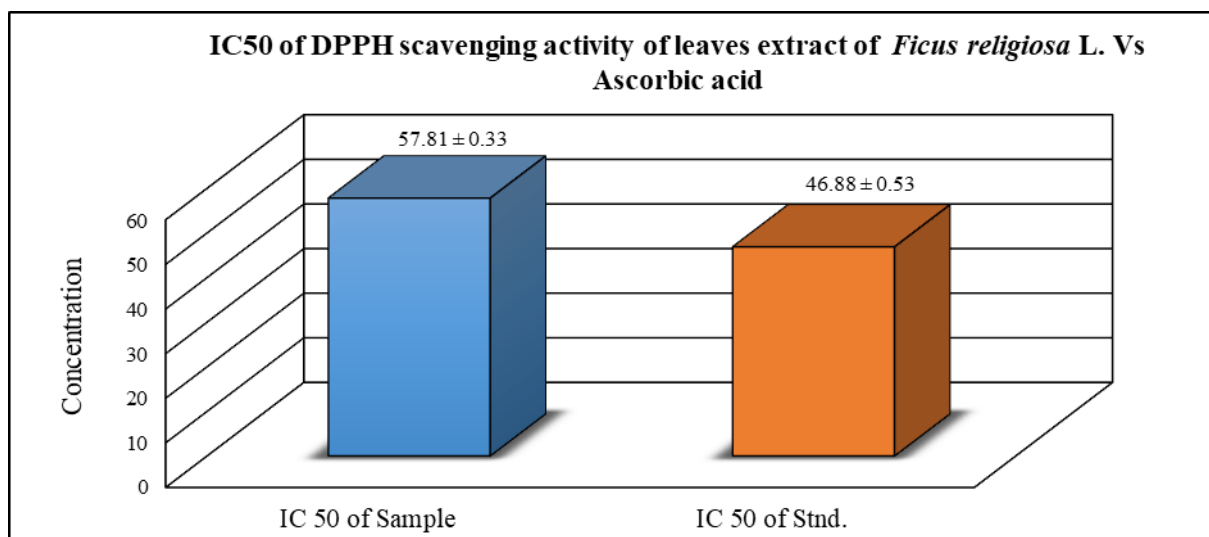


Figure 4. IC50 of DPPH scavenging activity of leaves extract of *Ficus religiosa* L. Vs Ascorbic acid. The values indicate significant differences by one-way ANOVA, followed by Tukey's t-test $P < 0.05$

Hence, the more rapidly the absorbance decreases, the % inhibition increases and the more potent the antioxidant activity of the extract. The percentage of DPPH scavenging activity of methanolic extract of *Ficus religiosa* L. is presented in Table 4. The plant extract exhibited a maximum DPPH scavenging activity of $73.29 \pm 0.71\%$ at $100 \mu\text{g./ml.}$ whereas for ascorbic acid (standard) was found to be $74.49 \pm 0.89 \%$ at $100 \mu\text{g./ml.}$ The IC50 values of the methanolic extract of the plant and Ascorbic acid was found to be $57.81 \pm 0.33 \mu\text{g./ml.}$ and $46.88 \pm 0.53 \mu\text{g./ml.}$ respectively.

IV. CONCLUSION

In the present study, Preliminary phytochemical studies confirmed the presence of alkaloids, amino acids, carbohydrates, flavonoids, glycosides, tannins, proteins and steroids. Further studies were also carried out to ascertain its total alkaloidal, phenolic and flavonoidal content. The methanolic leaves extract has shown potential antioxidant activity against Ascorbic acid as standard. From the above results, we can thereby conclude that the leaves of *Ficus religiosa* L. are a natural source of antioxidants, which might be able to cure the oxidative stress-related diseases. However, further, *in-vivo* study, isolation and characterization of the phytoconstituents are required to identify the active compounds responsible for its promising activity.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. Suchandra Samanta Mandal, M.Sc. (Botany), KU, M.Sc. (Education), KU, M Phil. (Education), KU, Assistant Professor, K. Bed College, Krishnanagar, West Bengal, India and management of Netaji Subash Chandra Bose Institute of Pharmacy for providing the facilities to work.

CONFLICT OF INTEREST

The authors' Dr. Bhawana Sati, Dr. Nilip Kanti Deb, Soumya Saha declare no conflict of interest, financially or otherwise.

REFERENCES

- [1] The Wealth of India: A Dictionary of Indian Raw Materials and Industrial Products —Raw Materials Series. Publications and Information Directorate. CSIR, New Delhi, Rev Ser. 1992; 3(Ca-Ci).
- [2] Nadkarni KM, Indian Materia Medica, Bombay Popular Prakashan, Bombay, India, Reprint Edn, 1976, Vol. I.
- [3] Anonymous. Indian Pharmacopoeia, Vol II, New Delhi. The Controller of Publications, Ministry of Health and Family Welfare, Government of India, 1996.
- [4] Kirtikar KR. Basu BD. Indian Medicinal Plants. Archaeological Survey of India. India. 1987. <https://doi.org/10.1007/978-0-387-70638-2>.
- [5] Chandrasekar SB. Bhanumathy M. Pawar AT. Somasundaram T. Phytopharmacology of *Ficus religiosa*. Pharmacognosy reviews. 2010; 4(8): 195. doi: 10.4103/0973-7847.70918.
- [6] Sharma V. Mishra S. Yesudas R. Rajput RS. A review on *Ficus religiosa* (Sacred Fig). Int. J. Res. Anal. Rev. 2019; 6(2): 901-906. Available on https://ijrar.com/upload_issue/ijrar_issue_20543853.pdf
- [7] Khare CP. Indian Medicinal Plants: An Illustrated Dictionary. Springer-Verl Berlin Heidelberg. 2007.
- [8] Kokate C K. Purohit AP. Gokhale SB. Text book of Pharmacognosy. Nirali Prakashans, Pune. 2014; 50(9).
- [9] Tiwari P. Ansari A. Mahmood T. Ahsan F. A review on taxonomical classification, phytochemical constituents and therapeutic potential of *Ficus religiosa* (Peepal). Research Journal of Pharmacy and Technology. 2019; 12(11): 5614-5620. doi: 10.5958/0974-360X.2019.00972.7.
- [10] Chattopadhyay S. Deb J. Deb NK. Saha S. Das S. Chakraborty S. Mukherjee D. Preliminary phytochemical screening and in vitro evaluation of anthelmintic activity of leaves and stem bark of *Mangifera indica* L. (Anacardiaceae). Journal of Pharmacognosy and Phytochemistry. 2023; 12(6): 312-317. doi: 10.22271/phyto.2023.v12.i6d.14796.
- [11] Deb J. Dash Kumar G. Pharmacognostical studies on stem bark of *Acacia ferruginea* DC. Der Pharmacia Lettre. 2014; 6(3): 61-66. Available on https://www.researchgate.net/publication/286850651_Pharmacognostical_studies_on_stem_bark_of_Acacia_ferruginea_DC.
- [12] Harborne JB. Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. Chapman and Hall Ltd; London, UK. 1973; 3rd ed.: 20-28.
- [13] Abdel-Hameed ESS. Total phenolic contents and free radical scavenging activity of certain Egyptian *Ficus* species leaf samples. Food Chem. 2009; 114(4): 1271–1277. <https://doi.org/10.1016/j.foodchem.2008.11.005>.

- [14] Surwase US, Shaikh GH, Patil SM, Hunsalkar SG, Chaudhary RY. Phytochemical Investigation and Preliminary Pharmacological Screening of *Alstonia scholaris* R. Br. As An Antipyretic. Asian Journal Research Chem. 2009; 2(3): 304-305. Available on <https://i-scholar.in/index.php/Ajrc/article/view/165660>.
- [15] Chang CC, Yang MH, Wen HM, Chern JC. Estimation of total flavonoid content in Propolis by two complementary colorimetric methods. Journal Food Drug Anal. 2002; 10(3): 178–182. doi:10.38212/2224-6614.2748.
- [16] Alali FQ, Tawaha K, El-Elmat T, Syouf M, El-Fayad M, Abulaila K, ... Oberlies NH (2007). Antioxidant activity and total phenolic content of aqueous and methanolic extracts of Jordanian plants: an ICBG project. Natural Product Research 21(12): 1121-1131. <https://doi.org/10.1080/14786410701590285>.
- [17] Vijayalakshmi N, Krishna Rao MR. Preliminary Phytochemical and Antioxidant Studies of Leaf extracts of one Medicinal plant, *Vitex negundo*. Research Journal of Pharmacy and Technology. 2020; 13(5): 2167-2173. doi: 10.5958/0974-360X.2020.00390.X.
- [18] Islam MS, Siddiki MAK. Phytochemical and Antioxidant Activities of Different Fractional Extracts of *Alstonia scholaris* Linn. Open Access Journal Complement Altern Med. 2020; 2(3): 171–180. doi: 10.32474/OAJCAM.2020.02.000140.
- [19] Salfarina R. Comparison of Lipid Peroxyl Radical Scavenging Activity and total Phenolic content of four selected Citrus species leaves Extract. Research Journal of Pharmacy and Technology. 2019; 12(4): 1590-1594. doi: 10.5958/0974-360X.2019.00264.6.
- [20] Swarnakumari S, Sasikala M, Mohan S, Divyanand Maharaj U, Kavipriya G. Estimation of Phenolic acid and Flavonoids in leaves of *Amaranthus viridis* and *Amaranthus spinosus*. Research Journal of Pharmacy and Technology. 2021; 14(7): 3889-3895. doi: 10.52711/0974-360x.2021.00675.
- [21] Latifa Nasser A, Abdulqawi, Syed Atheruddin Quadri. Evaluation of Antibacterial and Antioxidant activities of *Tribulus terrestris* L. Fruits. Research Journal of Pharmacy and Technology. 2021; 14(1): 331-336. doi: 10.5958/0974-360X.2021.00061.5.
- [22] Lim Chiew Vien, Sasikala Chinnappan, Mogana R. Antioxidant activity of *Garcinia mangostana* L. and *Alpha mangostin*: A Review. Research Journal of Pharmacy and Technology. 2021; 14(8):4466-0. doi: 10.52711/0974-360X.2021.00776.
- [23] Sasikala M, Mohan S, Nandha Kumar K, Sathish Kumar M, Varshini N. HPTLC and Antioxidant activity of Ethanolic Extract of *Ipomoea obscura* (L.) Ker Gawl Stem. Research Journal of Pharmacy and Technology. 2020; 13(10): 4661-4667. doi: 10.5958/0974-360X.2020.00820.3.
- [24] Lavanya D, Pooja Rao, Soundarya S, Surabhi TS, Prashith Kekuda TR. Antibacterial, Antifungal and Antioxidant activity of leaf and fruit of *Alangium salviifolium* L. (Cornaceae). Research Journal of Pharmacy and Technology. 2021; 14(5): 2745-2749. doi: 10.52711/0974-360X.2021.00484.
- [25] Badmanaban R, Risna Ali, Manjima Mathew, Sheethal Elizabeth Reji, Ambili Issac. Comparative Studies on Total Polyphenols, Flavonoids and Antioxidant Potential of some Marketed brands of packed Green Tea. Research Journal of Pharmacy and Technology. 2020; 13(7): 3179-3183. doi: 10.5958/0974-360X.2020.00562.4.