Bulletin of Pure and Applied Sciences.
Vol.40 B (Botany), No.1.
January-June 2021: P.24-29
Original Research Article

Print version ISSN 0970 4612
Online version ISSN 2320 3196
DOI: 10.5958/2320-3196.2021.00005.7
Available online at www.bpasjournals.com

Taxonomical and Ethnomedicinal Studies of *Ficus krishnae* L. (Dicotyledonae: Moraceae)

[1]Mukesh Kumar, [2]Sushil Kumar Upadhyay[#], [3]Praveen Kumar Verma, [4]Indu Sharma, [5]Raj Singh*

Author's Affiliation
[1,2,4,5]Department of Biotechnology, Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala, Haryana 133207, India
[3]Plant Diversity, Systematics and Herbarium Division, F.R.I. Derhradun, Uttarakhand, India
[#]ORCID: https://orcid.org/0000-0002-1229-4275

***Corresponding author**:
Prof. Raj Singh,
Department of Biotechnology, Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala, Haryana 133207, India
E-mail:
dr.rajsingh09@gmail.com;
sushil.upadhyay@mmumullana.org#
Received on 10.02.2021
Accepted on 25.05.2021

Keywords:
Ficus krishnae,
Makhan katorri plant,
Moraceace,
Ayurvedic medicine,
Anticancer,
Antimicrobial.

Abstract
Ficus krishnae commonly called as 'Makhan Katori' is belonging to family Moraceae of class Dicotyledonae known for its cup-shaped leaves. Present study aimed to carried out diversity, distribution and ethnomedicinal values of *Ficus krishnae* at Forest Research Institute (F.R.I.), Dehradun (Uttarakhand) India. The plant profoundly used in Ayurvedic medicine to cure various diseases such as ulcers, fever, leprosy, vomiting, dysentery, syphilis and inflammation of liver. The roots, stems, leaves, and fruits of *F. krishnae* has been studied for antibacterial, anti-oxidant, anti-diabetic, anti-inflammatory, anticancer, antimicrobial and immunomodulatory effects. During investigation, minimum leaf size was recorded 8x7 cm^2 however; the maximum size noticed 25x11 cm^2. The fig size of *F. krishnae* ranged between 1 mm to 3 mm.

How to cite this article: Kumar, M., Upadhyay, S.K., Verma, P.K., Sharma I., Singh, R**.** (2021). Taxonomical and Ethnomedicinal Studies of *Ficus krishnae* L. (Dicotyledonae: Moraceae). *Bulletin of Pure and Applied Sciences-Botany,* 40B (1), 24-29.

INTRODUCTION

The term flora is a common word used for the plant life happening in a meticulous habitat and geographical area, usually taking place naturally. Plants are essential for the universe as a source of oxygen, food, shelter, habitat, fuel, natural resources, etc. (Berrens, 2019; Singh et al., 2020a). These are playing vital role in creation and management healthy ecosystem. The plants species cultivated to fulfill the requirement of populace and used for various socioeconomic and ethnomedicinal purposes, food, fiber, timber, etc. as well (Singh et al., 2018a; Singh et al., 2019a; Singh et al., 2020b, Singh et al., 2020c). Among these plants, *Ficus krishnae* a species of family Moraceae (Mulbery) and class Dicotyledonae reflecting pivotal role in nature as wild as well as planted flora. The family Moraceae is containing approximately 37 genera and 1100 species (Clement and Weiblen, 2009). *F. krishnae* is known as Makhan katori and Krishna fig in hindi, however Krishna butter cup in english because of its cup-shaped leaves (Balamurugan et al., 2012). It is a native plant of India and distributed in Shri Lanka and Africa as well. A mythological story related to

F. krishnae that Lord Krishna was very fond of butter and would even steal it because of its uniqueness and cup-shaped leaf. Mother Yashoda caught him when he tried to hide the butter by rolling it up in a leaf of this tree. Since then leaves of the trees have retained cup-shape (Unnikrishnan and Hema, 1990). *F. krishnae* is not only different from *Ficus benghalensis* because of its cup-shaped leaf structure but also different in many properties including height of tree, leaf appendages, aerial roots, petiole and stipules shape and size. Additionally these are having differences in chromosomes, DNA contents and nodal anatomy. Morphological, cytological and anatomical evidences of *F. krishnae* is reinstated here as a correct species (Chaudhary et al., 2012). The extract of various parts of this plant have shown significant medicinal property like anti-oxidant, anti-diabetic, anti-inflammatory, anticancer, antimicrobial and immunomodulatory effects (Huffman, 2003; Miller et al., 2004; Singh et al., 2020b,c). The amalgamation and nanoformulation of fruits and parts of plants can enhance the medicinal efficacy and associated targeted delivery for management of several diseases (Yadav et al., 2016; Singh et al., 2020f; Singh et al., 2021a; Singh et al., 2021b; Singh et al., 2021c). This study will be useful in morphotaxonomical documentation and provide elementary ethnomedicinal information for further study on *F. krishnae*.

MATERIALS AND METHODS

Present study was designed to work out the diversity, distribution, socioeconomic and ethnomedicinal importance of Makhan katori plant *Ficus krishnae* (Dicotyledonae: Moraceae) at Forest Research Institute (F.R.I.), Dehradun (Uttarakhand) India. Vegetation is deciduous and evergreen spread over more than 1100 acre and presently known as New Forest. The overall campus thoroughly surveyed to collect the plant sample, fruits, leaves and onsite key taxonomic characteristics were recorded. The collected samples were brought to laboratory and species have been identified through relevant key to the literature and through herbarium specimens housed in Systematic Botany Discipline, F.R.I., Dehradun (Uttarakhand). The correlation in morphotaxometric observations were substantiated using advanced numerical tool.

RESULTS

The *Ficus krishnae* plants are tree with wide crown and 18-22 m height as well as with or without aerial roots (Figure 1.1). These young plants were observed epiphytic during investigation as well. The stem and branchlets were strong with pale gray and smooth bark (Figures 1, 2). Petiole robusty, strong (2-5 cm), leaf elliptic and cup shaped at the base (8-25 x 7-11 cm^2), thickly leathery, abaxially pale green, adaxially dark green and shiny, base broadly cuneate, margin entire, apex acute, secondary veins many and closely parallel (Figures. 1.3, 1.4). Stipules dark red colour when mature and cremish colour in young stage, membranous, caducus in nature with 10 cm size (Figure 1.5). Figs were axillary, paired, sessile, globose, silky, pubescent, basal bracts sub-orbicular. The syconus fruits were scarlet red when ripe (Figure 1.6). The male and female flowers were recorded in same receptacle. Male flowers were numerous near the mouth of the receptacle and stamens (Figure 2). In *F. krishnae* species the minimum leaf size (8x7 cm^2 to 15x9 cm^2) and maximum size (22x9 cm^2 to 25x11 cm^2) was recorded. The numerical assessment of fig size, leaves area, and their correlation with length and breadth was worked out and illustrated (Figure 2). The fig size of *F. krishnae* ranged between 1 mm to 3 mm.

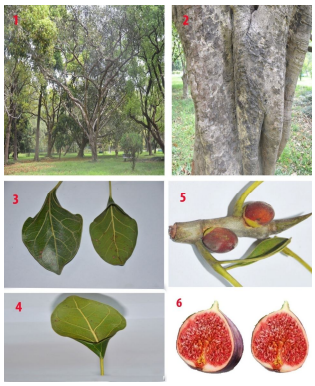

Figure 1: *Ficus krishnae*: Tree (1), Bark (2), Leaf surface (3), Leaf shape (4), Axillary fruits (5), Sagittal section of ripe fruit (6).

DISCUSSION

The medicinal potential of wild plants are well acknowledged from the early time of the great epics of the Ramayana and Mahabharata and written in the oldest Hindu scriptures, *viz.,*

Rigveda (Singh et al., 2020d; Singh et al., 2020e; Singh et al., 2021d). The phytochemical analysis of *F. krishnae* revealed the presence of alkaloids, cardiac glycosides, saponins, flavonoids, tannins and carbohydrates (Joshi et al., 2012). The findings were corroborated to the earlier investigation to hepato and cardioprotective activity of flavonoids (Sehrawat et al., 2020; Yadav et al., 2020; Aggarwal et al., 2021; Yadav et al., 2021). The antimicrobial activities derived from roots, stems, leaves, flowers and fruits of plants, against bacteria, fungi, viruses and various wounds in animal tissues etc. (Gordon, 2001; Kumar et al., 2018; Upadhyay et al., 2019; Devi et al., 2020; Rani et al., 2020). The bark and stem of *F. krishnae* act reservoir for bioactive compounds flavonoids, phytochemicals and phenols as bioactive molecules against several diseases similar to some profound medicinal plants (Biswas, 1934; Helen et al., 2013; Singh et al., 2018b; Aggarwal et al., 2020; Kumar et al., 2021; Singh et al., 2021e). In the Ayurveda all parts are used to cure diseases of 'Kapha'. It is astringent to bowels; useful in treatment of ulcers, vomiting, vaginal complaints, fever, inflammations and leprosy (Singh et al., 2019a; Singh et al., 2020b; Singh et al., 2020c). Latex is aphrodisiac, tonic; useful in piles and gonorrhea, urinary tract infection, helminthiasis, microbial infection etc. (Upadhyay, 2016a; Upadhyay, 2016b; Upadhyay, 2016c; Singh et al., 2019b; Singh et al., 2020b; Singh et al., 2020c; Doharey et al., 2021). The aerial root is styptic, useful in syphilis, biliousness, dysentery, inflammation of liver etc. (Kirtikar and Basu, 2005). Similarly the multifaceted potential of some aquatic herbs and terrestrial plants ladened with numerous value aided and therapeutic properties has been worked out to cure these diseases as well (Sharma et al., 2020; Singh et al., 2020f). It has been proven to have anti-diabetic and anti-hyperlipidemic activities and corroborated to earlier publish several literatures (Lakshmi et al., 2010; Tuli et al., 2020; Tuli et al., 2021). *F. krishnae* L. (Moraceae) has been used in traditional medicine for a wide range of ailments related to digestive, endocrine, reproductive, and respiratory systems. Additionally, it is also used in gastrointestinal tract and urinary tract infection (Badgujar et al., 2014).

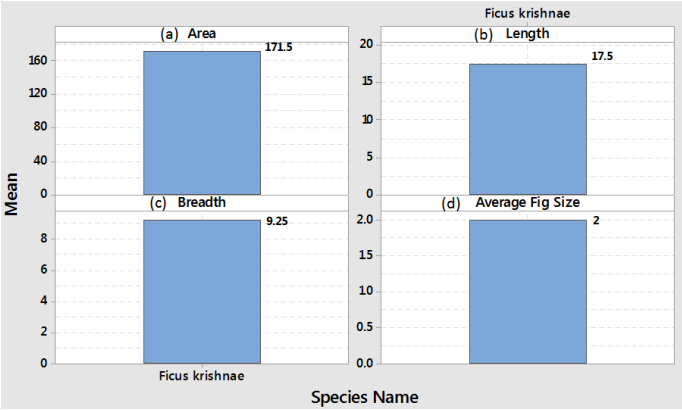

Figure 2: Bar chart illustrating correlation of leaves area (a), leaves length (b), leaves breadth (c) and average fig size (d) of *Ficus krishnae*.

CONCLUSIONS

Moraceae exhibit an amazing diversity of morphological and life history traits, particularly inflorescence architectures, breeding systems, and pollination syndromes. The monophyly of *Ficus* L. is strongly supported by molecular evidence, but only the combination of a few morphological characters is diagnostic, including milky latex, anatropous ovules, and apical placentation. These plants exhibited a range of growth habits including trees, succulent shrubs, and herbs, and also known for highly variable fig, leaves and branchlets morphology. Leaves stipulate, free, partially connate, but partially fused connate condition is uncommon. Fruits are dehiscent and indehiscent with fleshy perianth, receptacle, and exocarp in some cases. *Ficus krishnae* possesses various important pharmacological activities as summarised in present investigation. Thus *F.*

krishnae has emerged as a good source of traditional medicine for the treatment of various ailments such as anemia, cancer, diabetes, leprosy, liver diseases, paralysis, skin diseases, ulcers, etc.. It is a promising candidate in pharmaceutical biology for the development / formulation of new drugs and future clinical uses. Additionally, it is imperative that more pre-clinical and clinical studies along with the establishment of better quality control methods should be conducted to elucidate the unexplored potential of this plant.

Acknowledgement

Authors are immensely appreciative to Professor & Head, Department of Biotechnology, Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala (HR), India for permission and critical suggestions during collaborative research findings.

REFERENCES

1. Aggarwal, D., Upadhyay, S.K., Singh, R., Sehrawat, N., Yadav, M., Singh, M. and Kumar, V. (2020). Tissue culture propagation of *Bacopa monnieri* (L.) Pennell: An important medicinal plant. Advances in Bioresearch, 11(5), 97–103.
2. Aggarwal, D., Upadhyay, Sushil K., Singh, R. and Tuli, H.S. (2021). Recent patents on therapeutic activities of xanthohumol: A prenylated chalconoid from hops (*Humulus lupulus* L.). Pharmaceutical Patent Analyst, 10(1), 37–49.
3. Balamurugan, K., Nishanthini, A., and Mohan, V.R. (2012). GC–MS analysis of *Polycarpaea corymbosa* (L.) Lam whole plant. Asian Pacific Journal of Tropical Biomedicine, 2(3), S1289–S1292.
4. Badgujar, S.B., Patel, V.V., Bandivdekar, A.H. and Mahajan, R.T. (2014). Traditional uses, phytochemistry and pharmacology of *Ficus carica*: A review. Pharmaceutical Biology, 52(11), 1487–1503
5. Berrens, D. (2019). The meaning of flora. *Humanistica Lovaniensia J.* Neo-Latin Studies, 68(1), 237–249.
6. Biswas, K. (1934). Observations on the systematic position of *Ficus krishnae*. Current Science, 3(8), 424–427.
7. Chaudhary, L.B., Sudhakar, J.V., Kumar, A., Bajpai, O., Tiwari R. and Murthy, G.V.S. (2012). Synopsis of the genus *Ficus* L. (Moraceae) in India. Taiwania, 57(2), 193–216.
8. Clement, W.L. and Weiblen, G.D. (2009). Morphological evolution in the mulberry family (Moraceae). Systematic Botany, 34(3), 530–552.
9. Devi, A., Dahiya, V.S., Upadhyay, S.K. and Singh, R. (2020). Antimicrobial activity and phytochemical constituents present in *Syzium cumini* (L) seed, leaves and bark extract. Plant Archives, 20(2), 7787–7790.
10. Doharey, V., Kumar, M., Upadhyay, S.K., Singh, R. and Kumari, B. (2021). Pharmacognostical, physicochemical and pharmaceutical paradigm of ash gourd, *Benincasa hispida* (Thunb.) fruit. Plant Archives, 21(1), 249–252.
11. Gordon, D.M. (2001). Geographical structure and host specificity in bacteria and the implications for tracing the source of coliform contamination. Microbiology, 147, 1079–1085.
12. Helen, P.M., Aswathy, M.R., Rathi, K.D.R.M., Joseph, J.J. and Sree, S.J. (2013). Phytochemical analysis and anticancer activity of leaf extract of *Mangifera indica* (KotttukonamVarika). International Journal of Pharmaceutical Sciences and Research, 4(2), 819.
13. Huffman, M. A. (2003). Animal self-medication and ethno-medicine: exploration and exploitation of the medicinal properties of plants. Proceedings of the Nutrition Society, 62(2), 371–381.
14. Joshi, M.K., Gorwadiya, H.C. and Pandya, D.J. (2012). Phytopharmacognostical study on 'Makkankatori': *Ficus krishnae*. International Journal of Biomedicinal Research, 3, 427–430.
15. Kirtikar, K.R. and Basu B.D. (2005). Indian medicinal plants Volume III. Dehradun: International Book Distributors, 2312p.
16. Kumar, P., Upadhyay, S.K. and Singh, R. (2018). A study on recent trends in therapy of air borne communicable disease caused by *Mycobacterium tuberculosis*: The Tuberculosis. Bulletin of Pure Applied Sciences Zoology, 37A(2), 65–74.
17. Kumar, A., Singh, R., Upadhyay, S.K., Kumar, S. and Charaya, M.U. (2021). Biosorption: The removal of toxic dyes from industrial effluent using phytobiomass- A review. Plant Archives, 21(1sp), 1320–1325.

18. Lakshmi, S.M., Kumar, A.S., Srikanth, S., Vidyultha, K.T., Jyothi, G. and Choudari, D.M. (2010). Antidiabetic and antihyperlipidaemic activity of *Ficus krishnae* L. in alloxan induced diabetic rats. International Journal of Preclinical and Pharmaceutical Research, 1, 14–18.

19. Miller, K.L., Liebowitz, R.S. and Newby, L.K. (2004). Complementary and alternative medicine in cardiovascular disease: A review of biologically based approaches. American Heart Journal, 147(3), 401–411.

20. Rani, A., Upadhyay, S.K., Shukla, G., Singh, C. and Singh R. (2020). Efficacy of bacterial isolates against causal agent of late blight of potato, *Phytophthora infestans.* Indian Journal of Agricultural Research, https: / / doi.org / 10.18805 / IJARe A-5548.

21. Sehrawat, N., Yadav, M., Kumar, S. Upadhyay, S.K., Singh M. and Sharma, A.K. (2020). Review on health promoting biological activities of mungbean: A potent functional food of medicinal importance. Plant Archives, 20(2 Spl), 2969–2975.

22. Sharma, A.K., Sharma, V., Sharma, V., Sharma, J.K. and Singh, R. (2020). Multifaceted potential of *Eichhornia crassipes* (Water Hyacinth) ladened with numerous value aided and therapeutic properties. Plant Archives, 20(Spl. 2), 2059–2065.

23. Singh R., Upadhyay S.K., and Sunita (2018a). Phytodiversity of wild flora from Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala, Haryana, India. Bulletin of Pure and Applied Sciences Botany, 37B(2), 130–136.

24. Singh, R., Upadhyay, Sushil K., Kumar, A., Rani A., Kumar, P. and Singh, C. (2018b). Lignin biodegradation in nature and significance. Vegetos, 31(4), 39–44.

25. Singh R., Upadhyay S.K., Rani A., Kumar P., Kumar A. and Sharma P. (2019a). Ethanobotanical study of Subhartipuram, Meerut, Uttar Pradesh, India. I. Diversity and pharmacological significance of trees. International Journal of Pharmaceutical Research, 11(4), 782–794.

26. Singh, R., Upadhyay, Sushil K., Singh, M., Yadav, M., Kumar, V. and Sehrawat, N. (2019b). A report on antibiotic susceptibility and resistance of pathogens causing urinary tract infection (UTI) to human patients. Bulletin of Pure and Applied Sciences Zoology, 38A(2), 170–176.

27. Singh, R., Upadhyay, S.K., Rani, A., Kumar, P., Sharma, P., Sharma, I., Singh, C., Chauhan, N. and Kumar, M. (2020a). Ethnobotanical Study of Weed Flora at District Ambala, Haryana, India: Comprehensive Medicinal and Pharmacological Aspects of Plant Resources. International Journal of Pharmaceutical Research, 12(Spl.)1, 1941–1956.

28. Singh R., Upadhyay S.K., Rani A., Kumar P. and Kumar A. (2020b). Ethanobotanical study of Subhartipuram, Meerut, Uttar Pradesh, India. II. Diversity and pharmacological significance of shrubs and climbers. International Journal of Pharmaceutical Research, 12(2), 383–393.

29. Singh, R., Upadhyay, S. K., Tuli, H.S., Singh, M., Kumar, V., Yadav, M., Aggarwal, D. and Kumar, S. (2020c). Ethnobotany and Herbal Medicine: Some Local Plants with Anticancer Activity. Bulletin of Pure and Applied Sciences Botany, 39B(1), 57-64.

30. Singh, C., Chauhan, N., Rani, A. and Singh, R. (2020d). Restoration of world heritage site Nanda Devi Biosphere Reserve, Uttarakhand. Journal of Agriculture and Forest Meteorology Research, 3(5), 405–408.

31. Singh, C., Chauhan, N., Upadhyay, S.K. and Singh, R. (2020e). Phytochemistry and ethnopharmacological study of *Adiantum capillus-veneris* L. (Maidenhair fern). Plant Archives, 20(2): 3391–3398.

32. Singh, M., Renu, Kamboj, S., Kumari, S., Kamboj, V. and Upadhyay, S.K. (2020f). One pot synthesis of physico-chemically stabilized ZnO nanoparticles *via* biological method and its potential application as antimicrobial agent. Bulletin of Pure and Applied Sciences Zoology, 39A(1), 116–129.

33. Singh, M., Renu, Kumar V., Upadhyay, S.K., Singh R., Yadav, M., Seema, Kumari, S., Sharma, A.K. and Manikandan, S. (2021a). Biomimetic synthesis of silver nanoparticle from aqueous extract of *Saraca indica* and its profound antibacterial activity. Biointerface Research in Applied Chemistry, 11(1), 8110–8120.

34. Singh, R., Upadhyay, S.K., Singh, M., Sharma, I., Sharma, P., Kamboj, P., Saini, A., Voraha, R., Sharma, A.K., Upadhyay,

T.K. and Khan, F. (2021b). Chitin, chitinases and chitin derivatives in biopharmaceutical, agricultural and environmental perspective. Biointerface Research in Applied Chemistry, 11(3), 9985–10005.

35. Singh, R., Upadhyay, S.K., Upadhyay, T.K., Singh, B.J., Rani, A. and Singh, C. (2021c). Association analysis among fungi colonizing wheat crop residues during decomposition for sustainable and environment-friendly management of renewable natural resources. Biointerface Research in Applied Chemistry, 11(5), 13754–13764.

36. Singh, C., Chauhan, N., Upadhyay, S.K., Singh, R. and Rani, A. (2021d). The Himalayan natural resources: Challenges and conservation for sustainable development. Journal of Pharmacognosy and Phytochemistry, 10(1), 1643–1648.

37. Singh, R., Upadhyay, S.K., Singh, B.J., Verma, R., Sharma, I., Sharma, P., Rani, A. and Singh, C. (2021e). Allelopathic effect of eucalyptus (*Eucalyptus camaldulensis* Dehnh) on the growth of *Aloe vera*. Plant Cell Biotechnology and Molecular Biology, 22(21 & 22), 94–100.

38. Tuli, H.S., Bhatia, G.K., Sood, S., Debnath, P., Upadhyay, S.K., Kumar, P., Nene, A.G., Kumar, J., Punia, S., Talwar, S. and Yadav, P. (2020). *In Silico* evaluation of harmane & palmarin as α-Glucosidase inhibitors: Hope for the discovery of antihyperglycemic compounds. International Journal of Pharmaceutical Research, 12(1SP), 1331–1336.

39. Tuli, H.S., Sood, S., Bhatia, G.K., Debnath, P., Aggarwal, D. and Upadhyay, S.K. 2021. *In silico* analysis and molecular docking studies of plumbagin and piperine ligands as potential inhibitors of alpha-glucosidase receptor. Biointerface Research in Applied Chemistry, 11(2), 9629–9637.

40. Unnikrishnan, K. and Hema, K.S. (1990). Development of back-pocketed leaf in *Ficus krishnae* C. DC. Phytomorphology, 40(1-2), 151–157.

41. Upadhyay, S.K. (2016a). Allelopathic activities of specific microbial metabolites in the inland prawn fisheries off eastern Uttar Pradesh, India. International Journal of Scientific Research, 5(2), 415–416.

42. Upadhyay, S.K. (2016b). Activity patterns of cell free supernatant of antagonistic microbial strains in rodents host-parasite systems. International Journal of Science and Research, 5(4): 332–336.

43. Upadhyay, S.K. (2016c). Anthelmintic and food supplementary conscientiousness of apitoxin in poultry model. Research Journal of Recent Sciences, 5(10), 09–14.

44. Upadhyay, S.K., Singh, R., Kumar, P., Singh, M., Yadav, M., Kumar, V., Aggarwal, D. and Sehrawat, N. (2019). *In vitro* antitubercular activity of dihydropyridine-dicarboxamide and pyrazole derivatives against *Mycobacterium tuberculosis*. Bulletin of Pure and Applied Sciences Zoology, 38A(2), 102–109.

45. Yadav, D., Upadhyay, S.K., Anwar, M.F. and Unnithan, J.S. (2016). A review on the patents of various metal nanoparticles: Preparations and formulations. World Journal of Pharmacy and Pharmaceutical Sciences, 5(2), 1309–1317.

46. Yadav, M., Sehrawat, N., Singh, M., Upadhyay, S.K., Aggarwal, D. and Sharma, A.K. (2020). Cardioprotective and hepatoprotective potential of citrus flavonoid naringin: Current status and future perspectives for health benefits. Asian Journal of Biological and Life Sciences, 9(1): 1–5.

47. Yadav, M., Sehrawat, N., Upadhyay, S.K., and Kumar, S. (2021). Emerging renoprotective role of citrus flavonoid naringin: Current pharmaceutical status and future perspectives. Current Pharmacology Reports, 7(3), 96–101.