The Scientific Temper
Vol. 13, No. 1, January-June, 2022:pp 108-114
ISSN 0976-8653, E-ISSN 2231-6396
A Web of Science Journal
Email: letmepublish@rediffmail.com
Doc ID: https://connectjournals.com/03960.2022.13.1.108

Review on *Murraya koenigii*: Dietary Supplements and Highly Prosperous Plants of Pharmacological Value

Kavita Gahtori[1], Chanchal Aggarwal[2], Manjusha Tyagi[3], Atal Bihari Bajpai[4], Naina Srivastava[5], Shalini Singh[6], Shelly Singh[1] and Naveen Gaurav[1]*

[1]*Department of Biotechnology, School of Basic and Applied Sciences, Shri Guru Ram Rai University, Dehradun-248001, Uttarakhand, India.*
[2]*Department of Biotechnology, School of Applied and Life Sciences (SALS), Uttaranchal University, Dehradun- 248001, Uttarakhand, India.*
[3]*Department of Microbiology, School of Basic and Applied Sciences, Shri Guru Ram Rai University, Dehradun-248001, Uttarakhand, India.*
[4]*Department of Botany D.B.S (P.G) College Dehradun 248001, Uttarakhand, India.*
[5]*Department of Botany D.A.V (P.G) College Dehradun 248001, Uttarakhand, India.*
[6]*Department of Botany, School of Basic and Applied Sciences, Shri Guru Ram Rai University, Dehradun-248001, Uttarakhand, India.*
Corresponding author: naveensri17@gmail.com

ABSTRACT

Murraya koenigii (Curry tree) is a common culinary plant, its leaves are used from ancient times as a spice or merely as garnishing or seasoning and they not only enhance the flavor but also increase the nutritional value of food. Besides being a valuable ingredient curry plant has high medicinal value, it is being used since ancient times to treat various diseases, heal wounds, and also has cosmetic uses. This review highlights the morphological and taxonomical status of the curry plant along with its phytochemicals, pharmacological activity, medical importance, and ethnobotanical uses.

Keywords: *Murraya koenigii,* Curry leaf, Ethnobotanical, Phytochemicals, Pharmacological.

INTRODUCTION

India is a habitat for more than 50000 plants species among which most of them are used traditionally in herbalism, some medicinal plants are used directly to cure diseases or heal wounds, while some are included in our daily consumption to provide essential nutrients, in another way these plants with medicinal values are essential for us. India is having an extensive pool of natural resources and a prosperous record of traditional medicines; here the maximum population is still dependent on plant-based medicines for their primary medical treatment. The use of medicinal plants is not only cost-efficient but also has no or least side effects. One such plant is *Murraya koenigii* also known as Curry/Kari/Kadi Patta or Mitha Neem; it is well recognized in India and other neighboring countries. The curry plant is native to South Asia (India and Sri Lanka) and belongs to the citrus family Rutaceae. The leaves of the curry plant are being used for a long time to enhance flavor in food and is a very common ingredient in south Indian dishes. The therapeutic properties of the curry plant are well listed in different medicinal systems accomplished in India like Ayurveda, Naturopathy, Unani and local health care traditions; they utilize different parts of curry plant like leaves, roots, flowers, etc. to cure various health-related problems (Pandey et al., 2013). The curry plant is rich in Vitamins like A, B, C and E. Curry leaves are rich in iron and folic acid which helps to beat anemia (Modak et al., 2007). The phytochemicals constituents found in curry leaves may be helpful in fighting cancer, exhibits good liver health properties and neuroprotective properties, fight against oral health problems, stomach problems, heart-related problems, and many more (Handral et al., 2012). It is called by different names such as Karepaku (Andhra Pradesh), Kartaphulli (Bengal), Mitha Neem

(Himachal Pradesh), Kathnim, Curry/Kari Patta (Hindi), Karibevu (Karnataka), Kariveppilei (Kerala), Karivempu (Tamilnadu), Narasingha (Assam), Gandhela, Gandla, Gani (Uttarakhand), Bhursanga (Orissa), Mahanimb (Sanskrit), Gorenimb (Gujrat), Curry Leaf (English), Pindosine (Burmese), Karrry bald (Danish), Kerriebladeren (Dutch), Feuilles de cury (French), Curryblatter (German), Daunkari (Indonesian), Fogli de Car (Italian), Hoja (Spanish) (Mittal et al., 2017).

MORPHOLOGY

Plant

Murraya koenigii is a small semi-deciduous, spreading shrub or tree with a woody stem. It is dark green to brown in colour with various dots on it. The plant is 4–8.7 meters tall and 15-40 cm in diameter. It has a grey color bark and beneath its white bark is present and also it has longitudinal striations on it (Fig 1; Singh et al., 2014).

LEAVES

Curry leaves has a lemony aroma with a shiny and smooth texture. The curry leaves are compound, pinnate, exstipulate having reticulate venation and having ovate-lanceolate with an oblique base, with small 11-21 leaflets, each leaflet is 2-4 cm long and 1-2 cm broad. Leaflets are short-stalked, alternate having 0.5 cm long petiole (Parmar and Kaushal, 1982).

FLOWERS

The plant has small self-pollinating white color funnel-shaped flowers on it with a sweet aroma. The flowers are in cluster form with 1.12 cm diameter. The flowers of curry plant are bisexual, regular, stalked, complete, ebracteate, hypogynous, actinomorphic and pentamerous. Each cluster bears approximately 60 to 90 flowers, 5 lobed calyx with 5 petals of 5 mm length, stamen from size 4-6 mm and 10 in number, dorsifixed, arranged into circles of 5 each. The gynoecium (female reproductive organ) is found 5 to 6 mm (Parmar and Kaushal, 1982).

The fruits of curry plant are generally found in cluster form and can vary from 32 to 80 in number. The size of the fruit is small, ovoid to subglobose and can be wrinkled or rough with glands. The diameter of the fruit is 1 cm to 2 cm and length is approximately 1.4 cm to 1.6 cm and it gets black or red in color when ripen (Parmar and Kaushal, 1982).

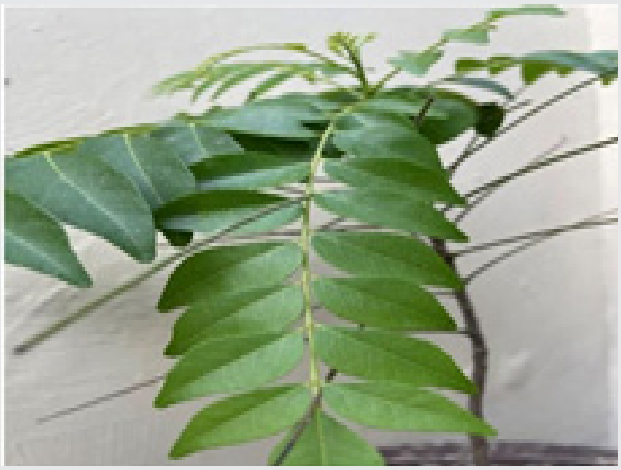
Seed: The seeds are of green color, with length of 11 mm and diameter of 8 mm (Parmar and Kaushal, 1982).

DISTRIBUTION

The curry plant is native to South Asia and is commonly found in India, Sri Lanka, Myanmar, Indonesia, Hainan and in some moist forests of China, Vietnam, Nepal, Laos, Bhutan, Pakistan, and Thailand. In India, it is distributed throughout the land but one can easily find this plant in Sikkim, Garhwal, Bengal, Assam, Western Ghats and Andaman Islands. This tree can grow in areas with abundant sunlight or even limited shade (Kumar et al., 2013).

Tree

Flower



Leaf

Figure 1: Morphology of *Murraya koenigii plant*

ETHNOBOTANICAL USES

Almost every part of the curry plant such as the leaf, bark, flower, seed, fruit and root contains constituents that are the reason behind the transition of numerous biological processes and is being used directly or indirectly to fulfill medical and other day to day needs.

Some traditional uses of different parts of curry plant are listed below.

1. **Leaves:** The fresh or dried leaves of curry plant are used directly for flavoring or seasoning. The curry leaves contain folic acid, iron, calcium, Vitamin A, B, and C and thus can be used as a natural supplement and can fight against anemia and calcium deficiency. The leaves can be eaten raw for curing dysentery, vomiting and nausea. In the case of indigestion, the curry leaves can be grounded into a fine paste and consumed along with buttermilk. The paste of curry leaves can be applied directly into the skin to fight against any kind of infection like boils, pimples and can also heal wounds. Curry leaves are also good for fighting against hair-related problems like greying of hairs, dandruff and hair fall (Nishan and Subramanian, 2015). Women have been applying curry leaves directly or indirectly for decades to deal with hair and skin-related problems (Singh et al., 2014). The tea made from leaves has also proven to lose weight and enhance memory. The fresh juice of curry leaves can even prevent the continuation of cataract (Kaur et al., 2017). They are also known to work against nephrotoxicity (Mahipal and Pawar, 2017).
2. **Roots:** The roots can be used in the treatment of poisonous animal bite. It cures kidney pain Leukoderma, Blood disorders, reduces inflammation and itching, and is used as a cooling agent (Abheysinghe et al., 2017).
3. **Bark:** The bark of the curry plant is used as a hair tonic, stomachic and carminative (Gahlawal et al., 2014).
4. **Stem:** The stem is used as a mouth and teeth cleanser (Goel et al., 2020).
5. **Fruit:** The fruit can be used as an astringent (Mandal et al., 2019).

PHYTOCHEMICALS

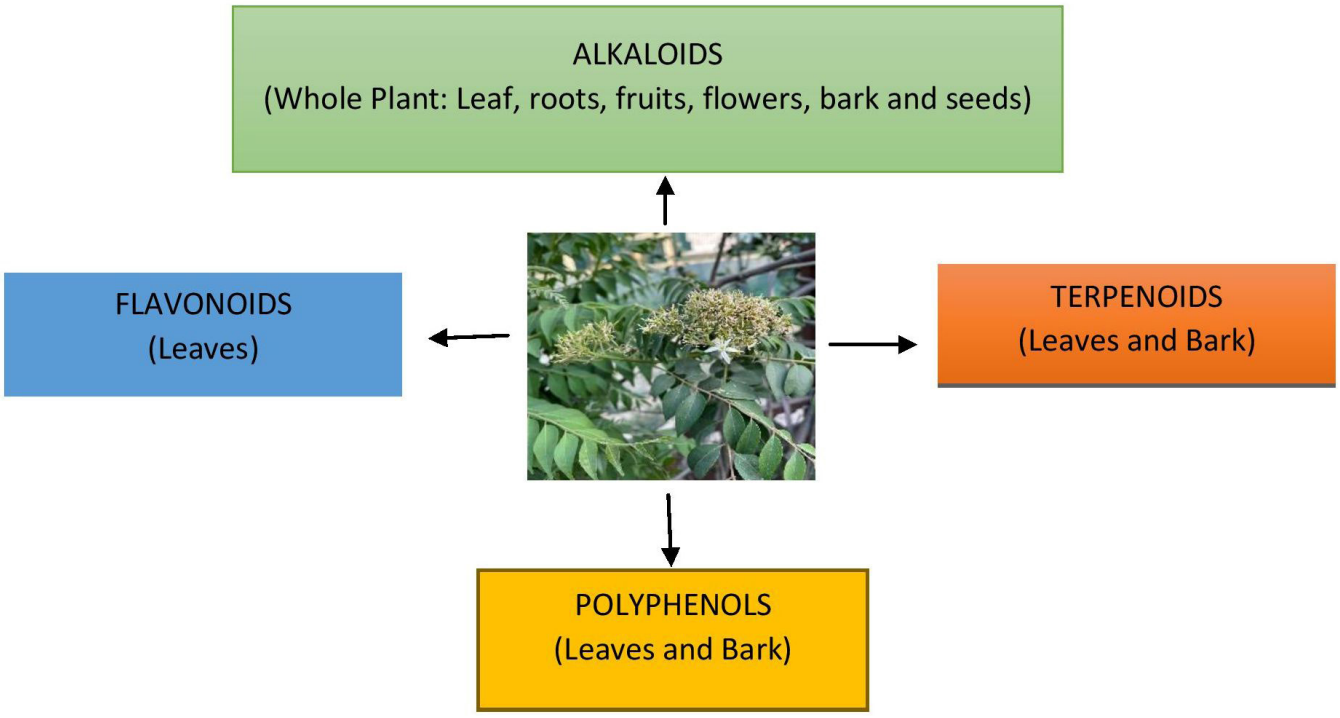


Figure 2: Major constituents in curry plant

The chemical substances produced by plants, which has a definite physiological action on the human body and protect against diseases are phytochemicals. The most common phytochemicals found in curry leaves are alkaloids, flavonoids, glycosides, tannins, sterols and phenolic compounds.

The presence of phytochemicals was observed after performing the following test. The alkaloids were confirmed through Mayer's test by using an alkaloidal precipitating reagent (Mayer's reagent). To indicate the presence of proteins Millon's test, Biuret/Piotrowski's *test* and Ninhydrin test were performed. When the hydro-alcoholic extract and chloroform along with the few drops of acetic anhydride and concentrated sulphuric acid was shaken, there was a formation of blue to a red color indicating the existence of triterpenes (Fig. 2). When a few drops of 5% lead acetate solution were mixed with alcoholic extracts of curry roots, a white precipitate formed, indicating the presence of phenolic chemicals. The appearance of yellow color in filter paper when dipped in ammoniated alcohol and aqueous extract confirms the existence of flavonoids in curry plant. The extract when shaken along with sodium bicarbonate showed honeycomb-like frothing confirming Saponins (Mittal et al., 2017).

The leaves of *M. koenigii* contain chemical compounds like glycosides, resin, girinimbin, koenine, koenigine, oxalic acid, carbazole alkaloids, koenidine, koenimbine, iso-mahanimbin, Mahanimbicine, bicyclomahanimbicine, phebalosin, coumarine, triterpenoid alkaloids like cyclomahanimbin and tetrahydromahanmbine, Murrayastine, murrayaline, pypayafolinecarbazole alkaloids and many more (Gupta, 2018; Rajvanshi and Mittal, 2018). In an Experiment, three different extracts of leaf were taken using solvents Methanol, aqueous and Ethanol 25 ml each dissolved in 1 gram curry leaf and the following phytochemical screening was observed (Rajvanshi and Mittal, 2018) (Table 1).

Table 1: Phytochemical Profiling of leaf extracts

	Aqueous	Methonol	Ethanol
Steroids	+	+	+
Alkaloids	+	+	+
Glycosides	+	+	+
Terpenoid	+	+	+
Phenols	+	-	+
Quinone	+	-	-
Cardiac glycosides	-	+	+
Tannins	+	+	+

(+ Present, - Absent)

The dried roots were powdered and extracted with ethanol, chloroform, petroleum ether and ethyl acetate in a sequence. The phytochemical screening was done which indicated the presence of different constituents like carbohydrates (in all extracts except chloroform), alkaloids (in chloroform extract), amino acid (ethanol), sterols and flavonoids (ethyl acetate and ethanol) **(Vats et al., 2011) (Table 2).**

Table 2: Phytochemical Screening of extract of the root

	Ethanol	Chloroform	Petroleum Ether	Ethyl Acetate
Carbohydrates	+	-	+	+
Flavonoids	+	-	-	+
Amino acids	+	-	-	-
Alkaloids	-	+	-	-
Sterols	+	-	+	+

(+Present, - Absent)

The chemical components found in the bark and stem of the curry plant are carboxylic acid, carbazole alkaloids, glycolipids, coumarin galactoside, Phospholipids, etc. The Bark mainly contains carbazole alkaloids asmurrayazolidine, koenioline murrayazoline, murrayacine, mahanimbine, girinimbine and xynthyletin. The pulp in fruit contains a high amount of proteins and a very small amount of minerals, phosphorus, potassium, calcium, magnesium and iron. The fruit also has a total sugar content of 9.76%, reducing sugar (9.58%), non-reducing sugar (0.17%), moisture (64.9%), vitamin C (13.35%) and a small amount of tannin and acids. Minerals such as 1.97 percent phosphorus, 0.082 percent potassium, 0.811 percent calcium, 0.166 percent magnesium, and 0.007 percent iron can be found in the pulp of fruits. The stem of curry plant has alkaloids possessing antimicrobial activity **(Gupta, 2018)**. Curry plant seeds contain 4.4 percent total lipid (85.4 percent neutral lipids, 5.1 percent glycolipids, and 9.5 percent phospholipids), 73.9 percent triacylglycerol, 10.2 percent free fatty acids, and trace amounts of diacylglycerols, monoacylglycerols, and sterols, as well as trace amounts of diacylglycerols, monoacylglycerols, and sterols. The seeds also contain phospholipids, furocoumarin lactone, carbazole alkaloids, glycolipids, and terpinene. In the plant extract, alkaloid mahanineare is the major bioactive component as compared to the other chemical constituents. The alkaloids are best known for their pharmacological activities as antioxidant, anti-inflammatory, antitumor, antiviral, antidiarrheal and diuretic **(Handral et al., 2012)**.

PHARMACOLOGICAL ACTIVITY

Researchers have discovered a variety of pharmacological activities in Murraya koenigii, with the cause being the presence of several phytochemicals in the plant in varied compositions **(Fig. 3; Sharma et al., 2016; Rautela et al., 2018)**.

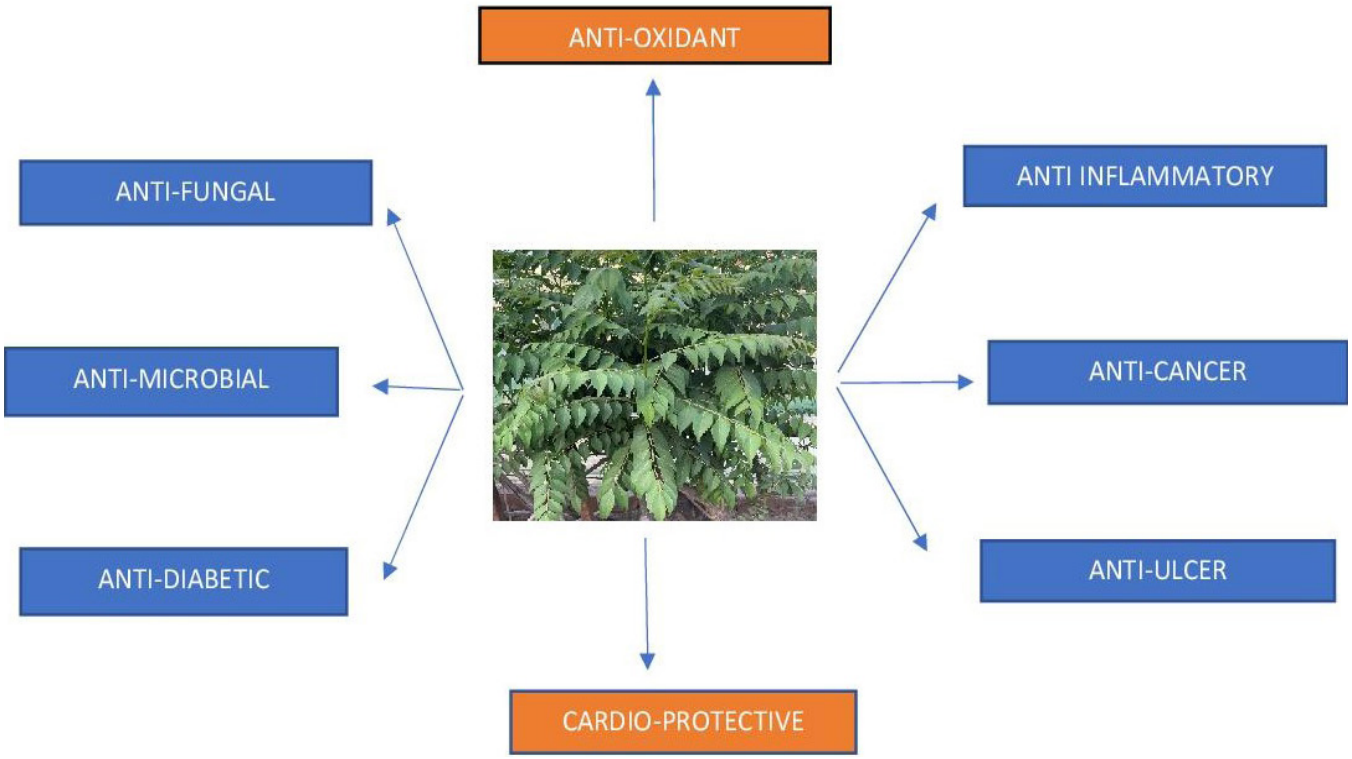


Figure 3: Major Pharmacological activity of curry plant

1. **Anti-Oxidant:** Increases the glutathione content in the liver and lowers the hepatic malondialdehyde (MDA) level.
2. **Anti-Microbial:** Exhibit Topoisomerase I and II inhibition activity.
3. **Anti-Diabetic:** Act on paraoxonase 1 (PON1) activity.
4. **Anti-Ulcer:** Effect against lesion index.
5. **Anti-Cancer:** Arrest cell proliferation by inhibiting proteasome function.
6. **Anti-inflammatory:** Cox-Inhibitory property
7. **Cardio protective activity:** The flavonoids and phenols in the curry plant help to remove free radicals and lipid peroxidation and also decrease triglyceride levels.
8. **Anti-fungal:** Inhibit lipid and sterol synthesis in fungus and Inhibit lipase synthesis.

Also curry plant also shows Pharmacological activities like Neuroprotective activity by decreasing Glycemic Levels, reno-protective activity against unilateral renal ischemia (Anti-Nephrotoxicity), it shows reduction in gastrointestinal motility (Anti-Diarrheal Activity), it shows a very good effect against lesion index (Anti-Ulcer Activity), inhibit cavity formation in teeth, it stimulates digestive enzymes, Decreases total cholesterol, work as Anti Pyretic by reducing fever, increases Glutathione leading to reduction in induced chromosomal damages(Radioprotective and chemoprotective activity), work as memory enhancer, shows wound healing effect by acting against inflammatory Cells, has phagocytic activity, Insecticidal activity, Hypocholesterolemic activity, Antihelmintic activity, Analgesic and antinociceptive activity, Antiamnesic activity, Vasodilating activity, being rich in vitamin A it has eyesight improving property, act against trichomonas gallinae (Anti-Trichomonas) (Rajvanshi and Mittal, 2018; Jain et al., 2012; Jayaprakash and Ebenezer, 2012; Ahmad, 1999; Selamoglu, 2017) (Table 3).

Table 3: Various Pharmacological activities shown by different parts of the curry plant

S. No.	Pharmacological Activity	Plant Part
1.	Anti-inflammatory	leaf
2.	Hypocholesterole mic	leaf
3.	Anti-amnesic	leaf
4.	Memory enhancer	leaf
5.	Anti-helminthic	leaf
6.	Anti-bacterial	Bark, leaf
7.	Anti-cancer	Stem, bark

8.	Anti-diabetic	Whole plant
9.	Anti-fungal	leaf
10.	Antidiarrhoeal	Seeds
11.	Radioprotective, chemoprotective	leaf
12.	Analgesic, Antinociceptive	leaf
13.	Antioxidant	leaf
14.	Cardiovascular	leaf
15.	Skin pigmenting	leaf
16.	Anti-lipid peroxidative	leaf
17.	Anti-tumor	leaf
18.	Anti-ulcer	leaf
19.	Cytotoxicity	Roots, stems
20.	Wound healing activity	leaf
21.	Phagocytic activity	leaf
22.	Anti- Alzheimer's activity	leaf, Fruit, Stem
23.	Effect on dental caries	leaf, root, Stem
24.	Anti-trichomonal	leaf
25.	Anti-pyretic	leaf
26.	Anti-Amnesic	leaf, Stem

CONCLUSION

Medicinal plants are cheaper and easily available around the planet. Therefore, we need to increase the commercial use of medicinal plants as a good source of the drug. *Murraya koenigii* is an easily available multifunctional plant with a good potential to cure many common diseases and deal with daily life problems. Therefore, we must generate our interest in research on this plant for new drug discovery. It is necessary to utilize its maximum potential in pharmaceutical sciences for a better application in the future.

REFERENCES

Harish, K., Handral, Pandith, A. and Shruthi, S.D. (2012). A Review on Murraya Koenigii: Multipotential Medicinal Plant. *Asian Journal of Pharmaceutical and Clinical Research*. **5**:5-14.

Pandey, M.M., Rastogi, S. and Rawat, A.K.S. (2013). Indian traditional ayurvedic system of medicine and nutritional supplementation. *Evid Based Complement Alternat Med*.**10**.

Mittal, J., Jain, M., Gilhotra, R. and Singh, R.P. (2017).Curry leaf (*Murrayakoenigii*): a spice with medicinal property. *MOJ Biology and Medicine*. **2(3)**: 236–256.

Modak, M., Dixit, P., Londhe, J., Ghaskadbi, S. and Devasagayam T.P.A., (2007). Indian Herbs and Herbal Drugs Used for the Treatment of Diabetes. *J Clin Biochem Nutr*. **40(3)**: 163–173.

Singh, S., More, P.K. and Mohan, S.M. (2014). Curry Leaves (*Murraya koenigii* Linn. Sprengal) - A Mircale Plant. *Indian J.Sci.Res.***4 (1)**: 46-52.

Parmar, C. and Kaushal, M.K. (1982). *Murraya koenigii*. In: Wild Fruits. Kalyani Publishers, *New Delhi, India.* 45–48.

Kumar, S.R., Loveleena, D. and Godwin, S. (2013). Medicinal Property of *Murraya koenigii*- A Review. *International Research Journal of Biological Sciences*. **2(9):**80-83.

Nishan, M. and Subramanian, P. (2015). *Murraya Koenigii* (curry leaf)-A review on its potential. *International Journal of Pharm Tech Research.***7(4)**:566-572

Kaur, A., Gupta, V., Christopher, A.F., Malik, M.A. and Bansal, P. (2017). Nutraceuticals in prevention of cataract – An evidence-based approach. *Saudi J Ophthalmol*. **31(1)**:30-37.

Mahipal, P and Panwar, R.S. (2017). Nephroprotective effect of Murrayakoenigii on cyclophosphamide-induced nephrotoxicity in rats. *Asian Pacific Journal of Tropical Medicine*. **10(8)**:808-812.

Jain, V., Momin, M. and Laddha, K. (2012). *Murraya Koenigii*: An Updated Review. *International Journal of Ayurvedic and Herbal Medicine.* **2(4)**:607-627.

Vats, M., Singh, H. and Sardana, S. (2011). Phytochemical screening and antimicrobial activity of roots of *Murraya koenigii* (Linn.) Spreng. (Rutaceae). *Braz J Microbiol*. **42(4)**:1569-73.

Abeysinghe, D.T., Alwis, D., Kumara, K.A.H. and Chandrika, U.G. (2021). Nutritive Importance and Therapeutics Uses of Three Different Varieties (Murraya *koenigii*, *Micromelum minutum*, and *Clausena indica*) of Curry Leaves: An Updated Review. *Evid Based Complement Alternat Med* .**5523252**.

Gahlawat, D.K., Jakhar, S. and Dahiya, P. (2014). *Murraya koenigii* (L.) Spreng: an ethnobotanical, phytochemical and pharmacological review. *Journal of Pharmacognosy and Phytochemistry*. **3(3)**: 109-11.

Goel, A., Sharma, A. and Kulshrestha, S. (2020). A Phytopharmacological Review on *Murraya koenigii*: An Important Medicinal Plant. *Int. J. Pharm. Sci. Rev. Res*. **62(2)**:113-119.

Mandal, U. and Mahalik, G. (2019). Medicinal plants used against diabetes. *Medico Bio-wealth of India*.

Gupta, P. (2020). A Review on Therapeutic Use of *Murraya Koenigii* (L.). *Spreng*. **2(7)**:93-97.

Rajvanshi, R. and Mittal, K. (2018). Phytochemical Analysis of Curry Leaves. *International Journal of Science and Research*. **8(9)**:366-367.

Jayaprakash, A. and Ebenezer, P. (2012). Antifungal activity of curry leaf (*Murraya koenigii*) extract and an

imidazole fungicide on two dermatophyte taxa. *J. Acad. Indus. Res.* **1(3)**:124-126

Kartini, A. (1999). Chemical constituents of *Murraya Koenigii* (Rutaceae) and their biological activities, Malaysia: *University Putra Malaysia*. 1–25.

Selamoglu, Z. (2017). Polyphenolic Compounds in Human Health with Pharmacological Properties. *Journal of Traditional Medicine & Clinical Naturopathy*. **6(4)**.

Sharma, N., Rautela, I. and Sharma, M.D. (2016). Mass Propagation and GC-MS Analysis of Critically Endangered Plant *Withania Coagulans*. International Journal of Applied Biology and Pharmaceutical Technology. **7(2):** 64-70.

Rautela, I., Dhiman, M., Sharma, M.D. and Misra, P. (2018). *In vitro* regeneration of medicinal plant *Ephedra gerardiana*. Int J Pharm Sci & Res. **9(3):** 1183-88.