International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 01 Jan-Feb 2025, pp: 167-174 www.ijprajournal.com ISSN: 2456-4494

"Exploring The Medicinal Properties And Pharmacological Profile Of Murraya Koenigii : A Detailed Review"

Aaditi baburao kangane, Dr, Santosh S Dengale, Krutika Ramnath Daware, Shraddha Kiran Mahatme, Harshada Mahonar Patil.
B pharmacy Dr. Naikwadi College of pharmacy Jamgaon Tal. Sinnar Dist. Nashik.

Date of Submission: 01-01-2025 Date of Acceptance: 10-01-2025

ABSTRACT:
Murraya koenigii, usually known as curry leaves, is a notable zest and regular seasoning substance utilized in Indian families for planning rarities.It has been utilized customarily by the people to fix illnesses other than adding taste in food. Carbazole alkaloids which are extensively accessible in the roots, natural products, leave and bark has been represented their anticancerous, antinociceptive, antibacterial, antidiabetic and cell reinforcement exercises. Restorative plant items these days assume a significant part in the total populace. Individuals utilize home grown item in light of the fact that they are considered as protected, economical and less aftereffects. Murraya koenigii contains phytochemicals like saponins, proteins, steroids, tannin, sugars, alkaloids, flavonoids and glycoside. It has the skin further developing impact.

Keywords:Murraya Koenigii , Phytochemistry, Pharmacological exertion.

I. INTRODUCTION :

The utilization of plant-based regular items in the treatment also, anticipation of infections and wellbeing upgrade due to nutritive significance and pharmacological advantages has prompted the critical consideration of the logical local area and the overall population these days. Therapeutic plants are promptly accessible and give a financially savvy source with lesser after effects to grow new drugs.[1,2]

For example, in disease treatment, over 60% of all drugs on the ongoing business sector are regular items or imitates of regular products.[3] Moreover, research has showed that plant-based eats less rich with restorative spices are okay mediations that lower weight record (BMI), pulse, glycated hemoglobin (HbA1C), and cholesterol levels. Restorative spices may likewise decrease the quantity of drugs expected to treat numerous metabolic and noncommunicable infections, including diabetes, diseases, cardiovascular infections, corpulence, and most of metabolic and noncommunicable infections are connected with higher mortality and grimness rates.[4] Murraya koenigii which have a place with the group of Rutaceae addresses in excess of 150 genera and 1600 species. The leaves of this plant has been utilized broadly in indian culinary and the compound substance which answerable for its sweet-smelling trademark is P-gurjunene, P-caryophyllene, P-elemene and O-phellandrene2.[5] Murraya koenigii is an exceptionally significant plant for its trademark smell fragrance and restorative values. It is a significant therapeutic plant of our nation and is filled in pretty much every house for its fragrant leaves. Precise logical examinations have been led with respect to the adequacy of various plant parts in the treatment of different illnesses.[6]

Taxonomic Classification :
Kingdom-Plantae
Subkingdom- Tracheobionta
Superdivision- Spermatophyta
Division- Magnoliophyta
Class- Magnoliopsida
Subclass – Rosidae
Family- Rutaceae
Genus- Murraya J. Koenig ex L.
Species- Murraya koenigii (L.) Spreng.

Description :

Curry leaf plants can arrive at levels of 4-6m (13-20 Feet) and have trunk breadths of up to 40 cm (.16 inches). The leaves are pinnate, having 11-21 handouts that are 2-4cm long and 1-2cm wide. The leaves are emphatically scented, while the blossoms are minuscule, white, and fragrant. It has palatable minimal dark shiny berries or natural products, but its seeds a toxic.[7]

International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 01 Jan-Feb 2025, pp: 167-174 www.ijprajournal.com ISSN: 2456-4494

Figure :

Traditional Uses :

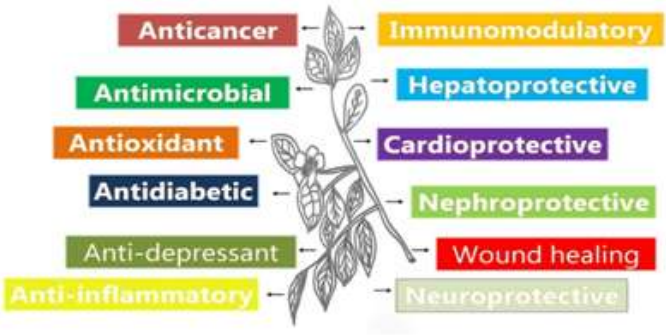
The barks and roots are utilized remotely to fix the nibbles of the harmful creatures; the green leaves were eaten crude as a remedy for looseness of the bowels, diarrhea [5]. Implantation of simmered leaves were provided to stop emesis [8].Further more, Murraya koenigii were like wise utilized as blood purifier, tonic and remedy for stomachache and utilized as seasoning specialists in curries and chutneys [9]. Curry leaves were additionally utilized as calcium source to those having lack of calcium other than that it likewise comprise Vitamin A, Vitamin B and B2, L-ascorbic acid and iron. For the therapy of morning infection; new squeeze of curry leaves along with lime squeeze and sugar is given and it is likewise appropriate for retching because of heartburn. On account of stomach disturbs, the curry leaves is grounded to a fine glue and blended in with buttermilk and drank orally. A glue of curry leaves is applied on the bubbles for quick help, other than that, renal aggravation can be restored by drinking the root as a juice . The new press of curry leaves can hinder the development of cascade.Murraya koenigii will hold the dark shade of the hair or in different words, it will forestall the untimely turning gray of the hair [10].

Phytochemistry :

The leaves of Murraya koenigii are found to have proteins, minerals, carotene, carb, fiber, L-ascorbic acid, nutrient A, nicotinic corrosive, calcium and oxalic corrosive. It moreover contains carbazole alkaloids, glasslike glycosides, koenigin, girinimbin, koenine, koenidine, iso-mahanimbin and koenimbine. Triterpenoid alkaloids,tetrahydroma hanimbine, cyclomahanimbine are additionally present in the leaves. Murrayaline, murrayastine, pyrayafoline carbazole alkaloids and bunches of different synthetic substances have been confined from Murraya koenigii leaves. [11]

The dinghy contains carbazole alkaloids like murrayazolidine, murrayacine, mahanimbine , koenioline, girinimbine and xynthyletin.While, organic products for the most part contain lessening sugar and modest quantity of acids and tannin other than containing Nutrient C. [12]

Pharmacological studies on Murraya koenigii :



International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 01 Jan-Feb 2025, pp: 167-174 www.ijprajournal.com ISSN: 2456-4494

Anti- cancer :

The secluded carbazole alkaloid that profoundly present in the Murraya koenigii leaves affect the development of the human leukemia cell line HL-60[13]. Nonattendance of necrotic cell, sore or shrinkage in cells of liver and kidney of the creatures were noticed proposing the non-poisonous nature of the treatment. It has quickly builds the pace of connective tissue arrangement.Koenoline disconnected structure root bark displayed cytotoxic action against the KB cell culture test framework. It has been found to prompt apoptosis in human myeloid disease cell (HL-60) [14, 15]. The in-vitro enemy of growth advancing action and cell reinforcement properties of Girinimbine disengaged from the stem bark of Murraya koenigii was concentrated by Yih et.al. The in vitro enemy of cancer advancing movement of not entirely set in stone by estimating the rate restraint of prompted early antigen (EA) of EBV on the outer layer of Raji cells[16].

Anti-microbial :

The hexane, methanol and chloroform concentrate of the Murraya koenigii root were tried against Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Salmonella typhi and contagious kind of Aspergillus niger, Candida albicans and Trichophyton rubrum. The hexane, methanol and chloroform concentrate of the base of Murraya koenigii was powerful on every one of the tried strains and methanol separate showed more huge antimicrobial action contrasted with the others with most extreme inhibitory impact on Staphylococcus aureus and Trichophyton rubrum. The Staphylococcus aureus were helpless to the every one of the three concentrates above, moreover the watery concentrate of the root were viewed as incapable against the tried microorganism14 [17].

Anti- oxidant :

The green verdant vegetables are known to have a high measure of cell reinforcements. Murraya koenigii leaves were seen to have most noteworthy cell reinforcement potential when contrasted and four other verdant vegetables [18]. As per the investigations, watery concentrates of Murraya koenigii leaves showed huge security instrument against cadmium initiated harm of heart tissues of the rats.23 Side impacts of Piroxicam actuated gastric harm in joint patients can be improved by Murraya koenigii was demonstrated by actuating gastric ulcers in rodents and treating them by Murraya koenigii [19]. Benzene part of Murraya koenigii was accounted for to have cell reinforcement as well as antimutagenic movement in trial animals [20].

Anti- diabetic :

Methanol concentrate of Murraya koenigii leaves are produce hypoglycemic result in human showed shifting hypoglycemic what's more, anti-hyperglycemic effect[21]. The watery concentrate of the leaves of Murraya koenigii after oral as well as intravenous organization to typical and alloxan diabetic canines created the hypoglycemia. the hypoglycemic movement of squashed leaves of Murraya koenigii in hares, human trained professionals and alloxan actuated diabetic rodents.Murraya koenigii additionally, credited to extended glycogenesis and reduced glycogenolysis and gluconeogenesis[22].

Anti-fungal activity :

Hostile to parasitic movement against Candida tropicalis, Candida albicans, Aspergillus treats, Aspergillus niger, Miniature sporumgypseum was seen by concentrates of Murraya koenigii leaves. The alcoholic concentrate of the leaves affirmed fungitoxicity towards Rhizoctonia solani and Colletotrichum falcatum.[23] Though methanolic and ethanolic separates were found successful against mycelia development in Rhizoctonia solani and Fusarium oxysporum with various efficiency.[24]

Wound healing:

Wound healing is a complex and multifactor process including various biochemical and cell processes which helps in the rebuilding of useful and physical progression. M. koenigii leaves broaden twisted mending in male pale skinned person rodents through essentially expanded injury withdrawal and diminished epithelialization, supporting the collagen amalgamation which was obvious in histopathological studies [25].

Anti- Inflammatory :

The leaves of Murraya koenigii was exposed to extraction with three different solvents; oil ether, chloroform and ethanol. A portion of 250mg/kg was chosen which is a 1/tenth of 2500mg/kg which was considered as LD50, the portion was administrated by means of oral course. Contrasted with the three solvents, it was seen that as ethanolic separate shows huge decrease in carrageenan actuated paw edema in the Pale skinned person rodents of the wistar strain21.[26]

Besides, it was found that the methanol and fluid the concentrate of Murraya koenigii

International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 01 Jan-Feb 2025, pp: 167-174 www.ijprajournal.com ISSN: 2456-4494

leaves is powerful against carrageenan-prompted edema in male pale skinned person rodents at the portion of 400mg/kg, contrasted with oil ether and hexane separates which has no abatement in the aggravation. The methanol separate was found to have a most extreme mitigating movement contrasted with fluid extract [27].

Immunomodulatory Activity :

The invulnerable framework makes an organization and directs processes significant for keeping up with the strength of a life form by upsetting the passage and attack of organisms. Hindrances in the resistant system lead to conditions from chronic inflammation to cancer [28]. Inaninvestigation on the humoral besides, cell-intervened safe response to ovalbumin, the immunomodulatory activity of a methanolic concentrate of M. koenigii leaves was evaluated using a carbon breathing space test. A broad development in the NO creation showed the extended phagocytic development of macrophages. The M. koenigii separate holds ensure as an immunomodulatory trained professional, which acts by stimulating humoral safety and the phagocytic capacity [29].The M. koenigii leaf eliminates were represented to have explicit impacts in overseeing mice immunology associated with oxidative tension processing.A M. koenigii leaf concentrate can display an immunomodulatory impact through which it can direct the oxidative pressure digestion in diabetic mice [30].

Hepatoprotective Effect :

Liver illnesses are an overall concern, and open clinical medicines have an insufficient efficacy. Since old times, spices have been utilized while treating different sickness conditions;plant extracts and natural compound shave significant applications as hepatoprotective agents. The liver is the site of medication digestion and the detoxification site of harmful items, thus it is the organ generally uncovered to xenobiotics [31]. M. koenigii broadened hepatoprotective movement when unrefined watery concentrates were explored against ethanol-prompted hepatotoxicity in exploratory creatures. M. koenigii was accounted for to broaden a defensive effect in liver impedances in ongoing liquor abuse and was ended up being effective in keeping up with the enzymatic oxidant status [32]. Water concentrates of carbazole alkaloids and tannin of M. koenigii were investigated for their hepatoprotective movement against ethanol-prompted hepatotoxicity in a HepG2cell line model. They showed phenomenal hepatoprotective action, keeping up with the enzymatic furthermore, non-enzymatic cell reinforcement level at a close to ordinary worth and furthermore keeping up with the honesty of the cells [33].A M. koenigii hydro-ethanolic leaf separate was represented to debilitate the CCl4 hepatotoxic impacts in rodents. M. koenigii-pretreated rodents showed a critical decrement in movement levels of hepatic markers and furthermore kept up with the degree of enzymatic cancer prevention agents [34].

Antihelmintic effects :

The leaves of Murraya koenigii behaves like antihelmintic influences, by which the ethanolic and watery concentrate of the leaves shows an antihelmintic influences against Pheretima posthuma and the both concentrate was consistent sum to the standard prescription Piperazine. It is acknowledged that tannins which are the polyphenolic compound found in Murraya koenigii leaves shows antihelminth influences. Futhermore tannins can act similar like the designed phenolic antihelmints, for instance, the bithionol, oxyclozanide and niclosamide by encroaching upon the energy age by uncoupling oxidative phosphorylation or by confining of the tannins to the free protein in the gastrointestinal parcel of the host or limiting to the glycoprotein on the fingernail skin of the parasite and causes the destructive ramifications for it[35]. The methanolic concentrate of Murraya koenigii shows anthelminthic effects against the Indian worm (Pheretima posthuma) in a part subordinate way. The methanolic remove causes the deficiency of movement of Indian worm at 18 minutes and advances destructive effect at 45 minutes[36].

Cardioprotective activity :

The examinations showed that the fluid concentrate of Curry leaf safe guards the rodent cardiovascular tissue against cadmium incited oxidative pressure potentially through its cell reinforcement movement. Treatment of rodents with cadmium likewise caused modifications in the exercises of mitochondrial Kreb's cycle as well as respiratory chain catalysts. This multitude of changes were enhanced when the rodents were pre-treated with a fluid concentrate of Curry leaf (Murraya koenigii).[37]

Anti ulcer activity :

Against ulcer action was noticed utilizing watery concentrate at portions of 200 and 400 mg/kg. It delivered huge hindrance of gastric sore

International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 01 Jan-Feb 2025, pp: 167-174 www.ijprajournal.com ISSN: 2456-4494

prompted by non-steroidal calming medications and pylorus ligation-actuated ulcer. The concentrate decreased ulcerative sore, gastric volume and free and add up to corrosiveness however raised the pH worth of gastric juice in pylorus ligation model. The outcomes acquired proposed that the concentrate has critical antiulcer activity [38].

Antipyretic activity :

The rodents were fevered with the parentral association of 10mg/kg of brewer‟s yeast and were found that the ethanol concentrate of Murraya koenigii leaves addresses an antipyretic development stood out from oil ether concentrate and chloroform independent, with paracetamol part of 150mg/kg as a standard medication [39].

Antidiarrhoeal activity :

Two bioactive carbazole alkaloids, to be explicit, kurryam and koenimbine got from fractionated n-hexane concentrate of the seeds of M. koenigii showed gigantic inhibitory activity against castor oil-impelled detachment of the entrails and prostaglandin E2-activated enteropooling in rodents.These mixtures likewise created a huge decrease in gastrointestinal motility in the charcoal dinner test in Wistar rats [40]. Das et.al has announced mahanimbine poisonousness against the hatchlings of Culex quinquefasciatus [41].

Nephroprotective Activity :

M. koenigii has been utilized as a nephroprotective specialist in a diabetic-prompted rodent model [42]. The M. koenigii leaf remove was viewed as efficient in keeping up with typical degrees of serum creatinine, blood urea nitrogen, complete serum protein, serum Na+, pee yield, urinary creatinine, urinary urea, complete urinary protein, and urinary Na+. Besides, the M. koenigii extricate kept up with the normal design in vivo cancer prevention agents, renal myeloperoxidase (MPO) action, and histopathology of kidneys against one-sided renal ischemia reperfusion injury. In this way, the concentrate of M. koenigii was plainly exhibited to be helpful in treating kidney problems in rodents .[43]

Effect on dental caries :

Taking care of departs of Murraya has proactively been polished since bygone eras to fix dental issues however tentatively it was seen in brilliant hamsters that were benefited from leaves furthermore, extricates. Isomahanine, Murrayanol and Mahanine were viewed as the dynamic fixings in the equivalent. The leaves could be considered being used in toothpaste, oral washes, biting gums and so forth to forestall oral issues and dental caries. [44, 45]

Cytotoxic activity :

Girinimbine, a carbazole alkaloid which is removed from the base of Murraya koenigii show cell passing through apoptosis in a portion subordinate way in A549 cells. Besides, the creator recommend that the cell passing initiated by the girinimbine can be by means of old style mitochondrial pathway with cytochrome C delivery and caspase subordinate apoptosis [46]. Moreover, Koenoline from the root bark were found to have an anticancer movement against KB cell culture and the carbazole alkaloids from the stems has impacts in the development on human leukemia cell line HL-60 [47].

Uses as cosmetics :

Leaves of M. koenigii have recently been used as a skin sanitizer.Washing from luke warm water having leaves extricates is said to fix diseases on the skin. Other than this, the capability of leaves in beauty care products has additionally been recognized. Appropriately, acting in skin has been found easing up and saturating because of the presence of cancer prevention agents and hyaluronidase inhibitory movement. The natural detailing has been evaluated in creams that in turn showed skin easing up and improvement in surface. Other than this sun security movement was additionally considered what's more, found that of could be utilized to improve regular pigmentation and could be utilized as additives[.48]

II. CONCLUSION :

Ongoing examinations are a lot supporting for the phytochemicals are being examined from food varieties for counteraction of infections. Countless palatable plants which have been utilized as medication and food sources by the Indian nation since antiquated times are producing ways for the disclosure of novel physiologically dynamic mixtures with restorative properties. The main variable connected with these compounds is the invalidated secondary effects that have an advantage over other clinical treatment of present times essentially allopathic, which represents numerous uncomfortable issues for the patient. India is biodiversity problem area and has a large number assortments of plant species conveying therapeutic properties in this column, Murraya koenigii, a plant utilized in Indian culinary as a

International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 01 Jan-Feb 2025, pp: 167-174 www.ijprajournal.com ISSN: 2456-4494

zing is found to convey a fortune of phytochemicals.It is extremely fascinating to know that rough natural concentrates separated from Murraya koenigii leaves have been surveyed for the couple of pharmacological exercises. They have displayed lipid-bringing down, Against diabetic, hostile to diarrheal, Hostile to oxidant, cytotoxic, Against microbial and Hostile to maturing property. Furthermore, the other plant parts like leaves, seeds and seed oil likewise have significant therapeutic advantages and they should be analyzed logically for their helpful properties. Further in future, there is a need to assess the detached phytochemicals from the plant for the advantage of humankind. It tends to be accomplished by utilizing logical exploratory creature models and clinical preliminaries to get the data about their activity component on the atomic level.

REFERENCE :

[1]. Atanasov A. G., Waltenberger B., Pferschy Wenzig E.-M., et al. Discovery and resupply of pharmacologically active plant-derived natural products: a review. Biotechnology Advances, 2015; 33(8): 1582–1614. doi: 10.1016/j.biotechadv. 2015.08.001. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

[2]. Yuan H., Ma Q., Ye L., Piao G. The traditional medicine and modern medicine from natural products. Molecules, 2016; 21(5). 559. doi: 10.3390/molecules21050559. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

[3]. Newman D. J., Cragg G. M. 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. doi: 10.1021/acs. jnatprod.9b01285. [PubMed] [CrossRef] [Google Scholar]

[4]. Hu J., Wang J., Gan Q.-X., et al. Impact of red yeast rice on metabolic diseases: a review of possible mechanisms of action. Journal of Agricultural and Food Chemistry, 2020; 68(39): 10441– 10455. doi: 10.1021/acs.jafc.0c01893. [PubMed] [CrossRef] [Google Scholar]

[5]. Muthulinggam N , Paritiban S. Murraya koenigii A review on its potential Int.J.PharmaTech Res, 2014-2015, 7 (4), pp 566-572.

[6]. Nayak S. Influence of Ethanol Extract of Vinca rosea on Wound Healing in Diabetic Rats. Online Journal of Biological Sciences. 2006 6(2):51-55.

[7]. Narasimhan NS., et al. “Murraya koinigi, structures of mahanimbine,koenimbine, mahanine, koinine, koenigine and koenidine”. Indian J Chem 13 (1975): 993-995.

[8]. Nayak A, Mandal S, Banerji A, Banerji J., Review on chemistry and pharmacology of Murraya koenigii Spreng (Rutaceae), Journal of Chemical and Pharmaceutical Research., 2010, 2(2), 286-299.

[9]. Sindhu R.K, Arora S., Evaluation of phenolic contents and antioxidant potential of Murraya koenigii (L) spreng roots, Journal of Applied Pharmaceutical Science., 2012, 2(11), 120-122.

[10]. Parul S, Javed A, Neha B, Honey J, Anuj B., Curry leaves- A medicinal herb, Asian Journal of Pharmaceutical Research., 2012, 2(2), 51-53.

[11]. Gupta GL, Nigamurraya SS, Chemical examination of the leaves of Murraya koenigii. Planta Med, 19, 1970, 83.

[12]. Chakrabarty M, Nath A, Khasnobis S, Chakrabarty M, Konda Y, Harigaya Y, Komiyama K Carbazole alkaloids from Murraya koenigii, Phytochemistry, 46, 1997, 751-755.

[13]. B. Maheswari Reddy., C.K. Dhanpal., B.V.S. Lakshmi., (2013). A review on curry leaves (Murraya koenigii): versatile medicinal plant, Biomed Journal, 6(1), 31-41.

[14]. J. Patterson., and M. Verghese., (2015). Anticancer and Toxic Effects of Curry Leaf (Murraya koenigii) Extracts., Journal of Pharmacology and Toxicology., 10(2), 49-59.

[15]. Vandana Jain., Munira Momin., Kirti Laddha, (2012). (Murraya koenigii: An Updated Review, International Journal of Ayurvedic And Herbal Medicine, 2:4, 607:627.

[16]. S.Yih Yih Kok , Lim Yang Mooi , Kartini Ahmad , Mohd Aspollah Sukari et.al , Anti Tumour Promoting Activity and Antioxidant Properties of Girinimbine Isolated from the Stem Bark of Murraya koenigii Molecules 2012; 17 (4): 4651-4660.

[17]. Malwal M, Sarin R., Antimicrobial efficacy of Murraya koenigii

International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 01 Jan-Feb 2025, pp: 167-174 www.ijprajournal.com ISSN: 2456-4494

(Linn.)Spreng.root extracts, Indian Journal of Natural Products and Resources., 2011, 2(1), 48-51.

[18]. Gupta S, Prakash J, Studies on Indian green leavesy vegetables for their anti-oxidant activity, Plant Foods Hum Nutr, 64, 2009, 39-45.

[19]. Firdaus SB, Ghosha D, Chattyopadhyay A, Duttaa M, Paul S, Janac J, Basua A, Bosea G, Lahiri H, Banerjee B, Pattari S, Chatterjee S, Jana K, Bandyopadhyay D, Protective effect of antioxidant rich aqueous curry leaf (Murraya koenigii) extract against gastro-toxic effects of piroxicam in male Wistar rats, Toxicology Reports, 1, 2014, 987-1003.

[20]. Zahin M, Aqil F, Husain FM, Ahmad I, Antioxidant Capacity and Antimutagenic Potential of Murraya koenigii, Biomedical research international, 2013, Article ID 263509.

[21]. Narasimha NS, Paradkar MV, Chitguppi VP, Kelkar SL. Alkaloids of Murraya koenigii: Structures Of Mahanimbine, Koenimbine, (-) Mahanine, Koenine, Koenigine, Koenidine and (+) - Isomahanimbine, Indian. Jour. Chem.1975 13(10): 993-99

[22]. Narsimha NS, Paradkar MV, Chitguppi VP. Structure of Mahanimbine and Koenimbine, Tetrahedron Left. 1968 53:5501-5504.

[23]. Kishore N, Dubey NK, Tripathi RD, Singh SK, Fungitoxic activity of leaves of some higher plants, National Academy Science Letters, 5, 1982, 9.

[24]. Rajnikant, Saima K, Chattree A, Antioxidant and Antifungal Potential of Murraya koenigii Leaves Extracts (Crude) and Essential Oil, Chemical Science transactions, 4, 2011, 222 226.

[25]. Nagappan, T.; Segaran, T.C.; Wahid, M.E.A.; Ramasamy, P.; Vairappan, C.S. E cacy of carbazole alkaloids, essential oil and extract of Murraya koenigii in enhancing subcutaneous wound healing in rats. Molecules 2012, 17, 14449–14463. [CrossRef] [PubMed]

[26]. Darvekar V.M, Patil V.R, Choudhari AB., Anti-inflammatory activity of Murraya koeniggi Spreng on experimental animals, Journal of Natural Product and Plant Resourse., 2011, 1(1), 65-69.

[27]. Prasad G.B.K.S, Dua V.K., Anti-inflammatory activity of leaves extract of Murraya koenigii L. International Journal of Pharma and Bio Sciences., 2011, 2(1), 541-544.

[28]. Kaufmann, T.; Simon, H.U. Targeting disease by immunomodulation. Cell Death Di er. 2015, 22, 185–186. [CrossRef]

[29]. Shah, A.S.; Wakade, A.S.; Juvekar, A.R. Immunomodulatory activity of methanolic extract of Murraya koenigii (L) Spreng. leaves. Indian J. Exp. Biol. 2008, 46, 505–509.

[30]. Paul, S.; Bandyopadhyay, T.K.; Bhattacharyya, A. Immunomodulatory e ect of leaf extract of Murraya koenigii in diabetic mice. Immunopharmacol. Immunotoxicol. 2011, 33, 691–699. [CrossRef]

[31]. Manfo, F.P.T.; Nantia, E.A.; Kuete, V. Hepatotoxicity and Hepatoprotective E ects of African Medicinal Plants. In Toxicological Survey of African Medicinal Plants; Elsevier: Yaoundé, Cameroon, 2014; pp. 223–256.

[32]. Shah, P.; Singh, S.P.; Kumar, A. Combined e ect of hydroethanolic extracts of Murraya koenigii and Phyllanthus niruri leaves on paracetamol and ethanol-induced toxicity in HepG2 cell line. Curr. Sci. 2015, 109, 1320. [CrossRef]

[33]. Sathaye, S.; Bagul, Y.; Gupta, S.; Kaur, H.; Redkar, R. Hepatoprotective e ects of aqueous leaf extract and crude isolates of Murraya koenigii against in vitro ethanol-induced hepatotoxicity model. Exp. Toxicol. Pathol. 2011, 63, 587–591. [CrossRef] [PubMed]

[34]. Desai, S.N.; Patel, D.K.; Devkar, R.V.; Patel, P.V.; Ramachandran, A.V. Hepatoprotective potential of polyphenol rich extract of Murraya koenigii L.: An in vivo study. Food Chem. Toxicol. 2012, 50, 310–314. [CrossRef]

[35]. Sharma U.S, Sharma U.K, Singh A, Sutar N, Singh P.J., In vitro antihelminth activity of Murraya koenigii Linn.Leaves extracts, International Journal of Pharma and Bio Science., 2010, 1(3), 1-4.

[36]. Kumar A, Tripathi A, Dora J, Tripathi R., Antihelmintic activity of methanolic extract of Murraya koenigii leaves (Linn), International Journal of Research in Pharmaceutical and Biomedical Sciences., 2011, 2(4), 1698-1700.

[37]. Elina Mitraa, Arnab K. Ghosha, Debosree Ghosha, Debasri Mukherjeea et.al,

Protectiveeffect of aqueousCurryleaf (Murraya koenigii) extract against cadmium-induced oxidative stress in rat heart, Food and Chemical Toxicology, 2012; 50(5):1340–1353.

[38]. Patidar DK. Anti-ulcer activity of aqueous extract of Murraya koenigii in albino rats. Int J Pharma Bio Sci, 2011; 2(1):524-529

[39]. Rageeb M.D, Usman M.D, Barhate S.D., Phytochemical evaluation and effect of antipyretic activity on Murraya koenigii Spreng. Leaves extract, International Journal of Pharmaceutical and Chemical Sciences., 2012, 1(1), 231-236.

[40]. Mandal S, Nayak A, Kar M, Banerjee SK, Das A, Upadhyay SN et.al, Antidiarrhoeal activity of carbazole alkaloids from Murraya koenigii Spreng (Rutaceae) seeds. Fitoterapia 2010; 8(1):72-74.

[41]. Das P. B., Chowdhury D. N., Choudhury B., Das G. K., Choudhury T. Roy, Studies On Some Alkaloids For Toxicity On The Larvae Of Culex qinquefasciatus, Ind J. Enviorn. Health,1996; 38(2):81-85.

[42]. Yankuzo, H.; Ahmed, Q.U.; Santosa, R.I.; Akter, S.F.U.; Talib, N.A. Beneficial e ect of the leaves of Murraya koenigii (Linn.) Spreng (Rutaceae) on diabetes-induced renal damage in vivo. J. Ethnopharmacol. 2011, 135, 88–94. [CrossRef]

[43]. Punuru, P.; Sujatha, D.; Kumari, B.P.; Charisma, V.V.L. Evaluation of aqueous extract of Murraya koenigii in unilateral renal ischemia reperfusion injury in rats. Indian J. Pharmacol. 2014, 46, 171–175. [CrossRef] [PubMed]

[44]. Keishiro I, Shinichi N T M, Satoe N, Foods Containing Murraya Extract For Prevention And Control Of Bad Breath Jpn, KokaiTokkyoKoho, 1996, 8.

[45]. Fumihiko T, Yoji Y, Koji S, Oral Disinfectant Formulations, Jpn, KokaiTokkyoKoho, 1995, 6.

[46]. Mohan S, Abdelwahab S.I, Cheah S.C, Sukari M.A, Syam S, Shamsuddin N, Mustafa M.R., Apoptosis effect of girinimbine isolated from Murraya koenigii on lung cancer cells in vitro, Evidence- Based Complementary and Alternative Medicine 2013., 2013, 1-12. http://dx.doi.org/10.1155/2013/689865 .

[47]. Handral H.K, Pandith A, Shruthi S.D., A review on Murraya koenigii: Multipotential medicinal plant, Asian Journal of Pharmaceutical and Clinical Research., 2012, 5(4), 5-14.

[48]. Tsuneo N, Yukio H, Kenji S, Masami N, Extraction of Hyaluronidase Inhibitors Form Azadirachta indica Or Other Plants for Manufacturing Cosmetics or For Therapeutic Use, Jpn, KokaiTokkyoKoho, 7, 1993, 72-79.