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INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)
(Int Peer Reviewed Journal)
Vol. 04, Issue 10, October 2024, pp : 364-373

e-ISSN : 2583-1062
Impact Factor : 7.001

A REVIEW ON ANTI-INFLAMMATORY, ANTIOXIDANT ACTIVITY AND OTHER ESSENTIAL ACTIVITIES OF TRIDAX PROCUMBENT & MURRAYA KOENIGII

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ABSTRACT

The increasing prevalence of chronic inflammatory diseases and oxidative stress-related disorders has prompted a renewed interest in the therapeutic potential of natural compounds. This review focuses on two promising medicinal plants, Tridax procumbens and Murraya koenigii, renowned for their traditional uses and rich phytochemical profiles. Tridax procumbens, commonly known as coat buttons, exhibits notable anti-inflammatory effects attributed to its flavonoid and alkaloid content. Meanwhile, Murraya koenigii, or curry leaf, is celebrated for its antioxidant properties, primarily due to its high concentration of phenolic compounds and essential oils. This review synthesizes existing literature on the mechanisms underlying their anti-inflammatory and antioxidant activities, highlights relevant pharmacological studies, and discusses their potential applications in modern medicine. By exploring these plants, we aim to elucidate their roles as natural therapeutic agents, offering insights for future research and development in herbal medicine.

1. INTRODUCTION

The increasing burden of chronic diseases linked to inflammation and oxidative stress has spurred interest in the exploration of natural remedies with therapeutic potential. Inflammation is a complex biological response to harmful stimuli, and while it plays a critical role in the body's defense mechanisms, chronic inflammation is associated with various health conditions, including arthritis, cardiovascular diseases, and cancer. Concurrently, oxidative stress, resulting from an imbalance between free radicals and antioxidants in the body, has been implicated in aging and numerous diseases. In this context, medicinal plants have emerged as valuable sources of bioactive compounds that exhibit both anti-inflammatory and antioxidant properties. Tridax procumbens (commonly known as coat buttons) is a widespread herb in tropical regions, traditionally utilized for its wound-healing properties and as a remedy for various inflammatory conditions. Recent studies have highlighted its rich phytochemical composition, including flavonoids, alkaloids, and tannins, which contribute to its therapeutic effects.Similarly, Murraya koenigii (curry leaf) is another plant renowned for its culinary uses and medicinal benefits. Traditionally used in Ayurvedic medicine, it has garnered attention for its high antioxidant content, particularly phenolic compounds and essential oils. These constituents not only enhance its flavor but also provide protective effects against oxidative damage, suggesting potential applications in managing oxidative stress-related diseases.This review aims to consolidate the current understanding of the anti-inflammatory and antioxidant properties of Tridax procumbens and Murraya koenigii. By examining their biochemical mechanisms and potential health benefits, we hope to highlight the significance of these plants in both traditional and modern therapeutic practices.

1.1 Murraya Koenigii

The literature on traditional medicine discusses its possible use as aMurraya koenigii, a member of the Rutaceae family, which includes more than 150 genera and 1600 species, is sometimes referred to as curry leaf or kari patta in Indian dialects(1). Murraya Koenigii is a highly prized plant because of its distinct scent and therapeutic benefits. Given that it generates substantial foreign cash, it is a significant export commodity from India. Every portion of the plant has had a variety of chemical components removed. The main chemical components that give it its strong, distinctive scent are O-phellandrene, P-caryophyllene, P-elemene, and gurjunene. The plant has a large amount of carbazole alkaloids(2). Ito evaluated bioactive coumarins, acridine alkaloids, and carbazole alkaloids from the Rutaceae family(3). Since ancient times, M. koenigii has been utilized extensively in Indian cuisine and has a variety of uses.

plant is said to have stomachic and tonic qualities. Roots and bark are utilized as

stimulant, as well as topically to treat animal bites and outbreaks. Raw green leaves are consumed to treat diarrhea, treat dysentery, and prevent vomiting. Traditionally, leaves and roots have also been employed as bitter,

anthelmintic, analgesic, effective in treating inflammation, itching, piles, leucoderma, and blood disorders(4,5). A number of comprehensive research investigations are currently being carried out to determine the effectiveness of whole plant or its components in various extract forms to cure various illnesses.

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M. koenigii is made up of a variety of chemical components that combine intricately to produce different pharmacodynamic effects. Many of the active ingredients that give the substance its therapeutic qualities have been identified and described.

Anti-oxidative, cytotoxic, antimicrobial, antibacterial, anti-ulcer, positive inotropic, and cholesterol-lowering properties have all been linked to this plant. Consequently, the current review compiles the body of research that has been done up to this point on the biological activities of the phytoconstituents that have been extracted, the pharmacological effects of extracts, and clinical investigations related to these topics(6–13).

The leaves are used to prevent vomiting and treat dysentery. They can be used topically for infections and bruising. Because of their analgesic properties, the leaves are useful in treating inflammation and itching. There have also been reports on this plant's several pharmacological properties, including its vasodilation, antibacterial, antidiabetic, antiulcer, analgesic, phagocytic, and antioxidant properties(14–16). Therehave alsobeen Several recent studies tha thavean ticipatedM. koenigiitopossess anti-inflammatoryactivitymainlyowing to thepresenceof its carbazole ealkaloids(17).


Taxonomical classification (18)

Kingdom	Plantae
Sub-kingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliospida
Subclass	Rosidae
Order	Sapindales
Family	Rutaceae
Genus	Murraya J.Koenig ex L.
Species	Murraya Koenigii L. Spreng

Synonyms(18)

English- Curry leaves; Kannada- Karibevu; Hindi- Karipatta, Mitha nim; Tamil- Kariveppilai; Malayalam- Kariveppu; MarathiKadhilimb; Sanskrit- Girinimba; Telugu- Karepeku; TuluBevusoppu; Portuguese- Folhas de caril; Russian- Listya karri; Spanish- Hojas de curry; Italian- Fogli di Cari; French- Feuilles de Cari; German- Curryblatter; Gujarathi- Mitho limado.

Table: 1 List of Active compounds of Murraya Koenigii and its biological activities

Murraya koenigii compounds	Source	Biological activity	Reference
Lutein	Leaves	Antioxidant activity	19
Tocopherol	Leaves	Antioxidant activity	19
		Hepatoprotective	20
Carotene	Leaves	Antioxidant activity	21
Koenimbine	Leaves	Antioxidant activity	19
O-methyl murrayamine A	Leaves	Antioxidant activity	22

O- methyl mahanine	Leaves	Antioxidant activity	22
Isomahanine	Leaves	Antioxidant activity	22
	Leaves	Anti caries	23
Bismahanine	Leaves	Antioxidant activity	22
Bispyrafoline	Leaves	Antioxidant activity	22
Euchrestine	Leaves	Antioxidant activity	24
Bismurrayafoline E	Leaves	Antioxidant activity	24
Mahanine	Leaves	Antioxidant activity	24
	Leaves	Anti caries	23
	Leaves	Hepatoprotective	20
	Stem and bark	Antimicrobial	25
		Topoisomerase I and II inhibitory activity	25
	Leaves	Hepatoprotective	20
1- formyl 3-mehoxy-6- methyl carbazole	Leaves	Anti bacterial and anti-fungal activity	26
6,7-dimethoxy-1-hydroxy-3-methyl carbazole	Leaves	Anti bacterial and anti-fungal activity	27
Mahanimbine	Leaves	Mosquitocidal	28
	Stem and bark	Antimicrobial	29
		Hepatoprotective	20
		Anti microbial	30
		Topoisomerase I and II inhibitory activity	30
		Antioxidant activity	30
		Antioxidant activity	31
		Toxicity on Culex quinquefsciatus larvae	32
	Stem bark	Anti fungal	33
Isomahanimbine	Leaves	Hepatoprotective	20
Murrayanol	Leaves	Mosquitocidal	28
	Leaves	Anti-microbial	30

Phytochemistry of Murraya koenigii

Murraya koenigii, commonly known as curry leaf, is rich in various bioactive compounds that contribute to its medicinal properties. Key phytochemicals identified in the leaves include:

1. **Alkaloids (36)**
   - Murraya koenigii contains several alkaloids, including mahanimbine, which exhibits anti-inflammatory and antioxidant effects.
2. **Flavonoids (36)**
   - The leaves are abundant in flavonoids such as quercetin, kaempferol, and rutin. These compounds are known for their potent antioxidant activities and potential to mitigate oxidative stress.
3. **Phenolic Compounds: (36)**
   - Phenolic acids, including gallic acid and caffeic acid, have been identified in the leaves. These compounds contribute to the plant's antioxidant capacity and possess anti-inflammatory properties.

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4. **Essential Oils:(34)**

- The essential oil of Murraya koenigii contains various volatile compounds, including β-caryophyllene, α-pinene, and limonene, which exhibit antimicrobial, antioxidant, and anti-inflammatory activities.

5. **Terpenoids:(34)**

- Terpenoids, including α-terpineol and β-sitosterol, are present in the plant and are known for their beneficial effects on health, including anti-inflammatory properties.

6. **Vitamins and Minerals (35)**

- Curry leaves are also a good source of vitamins (such as A, B, and C) and minerals (like calcium and iron), which play a role in overall health and contribute to their medicinal benefits.

Table 2: Pharmacological activities done on Murraya koenigii plant.(36)

Sl. No.	Pharmacological Activity	Plant part	Extract
1.	Anti-inflammatory	Leaf	Ethanol, Petroleum ether, Chloroform, methanol
2	. Anti-amnesic	Leaf	Petroleum ether
3.	Hypocholesterolemic	Leaf	Ethanol
4.	Memory enhancer	Leaf	petroleum ether
5.	Anti-helminthic	Leaf	Alcoholic
6.	Anti-bacterial	Bark, Leaf	Petroleum ether , Alcohol
7.	Anti-cancer	Stem bark	Petroleum ether
8.	Anti-diabetic	Whole plant, fresh leaf, fruit.	Aqueous, methanol
9.	Antidiarrhoeal	Seeds	n-hexane
10.	Anti-fungal	Leaf	Petroleum ether, alcohol and acetone
11.	Radioprotective and chemoprotective	Leaf	Methanol
12.	Analgesic and Antinociceptive	Leaf	Methanol
13.	Anti-oxidant	Leaf	Methanol and Aqueous
14.	Cardiovascular	Leaf	Aqueous
15.	Skin pigmenting	Leaf	
16.	Anti-lipid peroxidative	Leaf	Methanol
17.	Anti-tumor	Leaf	Petroleum ether
18.	Anti-ulcer	Leaf	Aqueous
19.	Cytotoxicity	Roots, stem	Aqueous
20.	Wound healing activity	Leaf	Ethanol
21.	Phagocytic activity	Leaf	Methanol

2.Tridax procumbens

Tridax procumbens, a species of flowering plant in the daisy family, is sometimes referred to as coat buttons (37) or Tridax daisy. Its most well-known use is as a common weed and pest plant. Although it originated in the tropical Americas, it has now been transported to mild, tropical, and subtropical global areas with moderate climate. It is classified as a harmful plant. Fields are home to this weed. lawns, roadside vegetation, disturbed areas, meadows, and regions with tropical or semitropical climates. India has historically used Tridax procumbens to cure wounds as well as an insect deterrent, antifungal, and anticoagulant. The liquid that is taken out of the leaves called juice administered immediately on injuries. Folks utilized its leaf extracts to treat infectious skin problems. It treats gastritis, liver diseases, hepatoprotection, and heartburn in Ayurvedic medicine (38-39). Some traditional healers in India also employ Tridax procumbens to cure cuts, boils, and blisters (40).

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Taxonomic Classification	
Kingdom	Plantae
Subkingdom	Tracheobionta
Division	Magnoliophyta
Subclass	Asteridae
Clade	Angiosperms
Order	Asterales
Clade	Eudicots
Family	Asteraceae
Tribe	Heliantheae
Genus	Tridax
Species	T. procumbens
Binomial name	Tridax procumbens

Taxonomical classification(41) (42) (43)

Table 2: Common names of Tridax procumbens throughout the world

Country/region	Common names	References
Chinese	Kotobukigiku	
English	Coat buttons, tridax daisy	hauhan BS and Johnson DE, 2008; Ravikumar V, et al., 2005; Bhagwat DA, et al., 2008)
French	Herbe cailli	
Latin	Tridax procumbens Linn.	
Kannada	Jayanthi	
Spanish	Cadillo chisaca	
Sanskrit	Kumminnippacha	
Telugu	Gaddi chemanthi	
Tamil	Thata poodu	
Assamese	Bikhalyakarani	
Hindi	Ghamra	
Bengali	Tridhara	

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Oriya	Bishalya karani	
Malayalam	Chiravanak	
Marathi	Kambarmodi, jakhamjudi and tantani	
Gujarati	Ghaburi	(Saxena VK and Albert S, 2005)
Japanese	Kotobukigiku	
Thai	Tīn túkkæ	
Nigeria	muwagun, muriyam pachila, jayanti, vettukkaaya-thala	(Sureshkumar J, et al., 2017)
United States	Tridax daisy	
Guatemala	Bull grass, bull's herb	(Gamboa-Leon R, et al., 2014)

Table 3: Phytochemicals present in different parts of Tridax procumbens

Extraction	Plant part	Compounds	References
Chloroform extract and Chloroform water extract	Leaves	oid, saponin, coumarins, alkaloids, amino acids, diterpenes, phenol and flavonoids, amino acids, phlobatannin	
Acetone-water extract and acetone extract	Leaves	Steroid, tannin, saponin, anthocyanin, coumarins, alkaloids, diter- penes, phenol and flavonoids, , proteins, carbohydrate, antioxidant property	
Methanol extract	Leaves	Alkaloids, tannin, anthocyanins, proteins saponin, steroid, phlo- batannin, terpenoids, flavonoids, amino acids, phenols and cardiac glycosides, antibacterial activity, antioxidant properties	(Dhanabalan R, 2008)
Ethanol extract	whole plant	itin, Alkaloids, tannins, flavonoids, saponins, and phenolic compounds	(Petchi RR, et al., 2013)
Acetone extracts	Roots, leaves	Antibacterial activity	
Aqueous extract	Leaves	Blood clotting properties	
ım ether and ethano- lic extract	Whole plant	cterial activity against B. faecalis due to presence of alkaloids, tannins, steroids, purines, carbohydrates, proteins	istudas S, et al., 2012)
Chloroform extract	Whole plant	Against B. faecalis and E. coli	istudas S, et al., 2012)
Aqueous extract	Leaves	DPPH radical scavenging activity (µg/mL)	(Singh P, et al., 2017)
Ethanol extract	Leaves	t, flavonoids, antibacterial activity against Pseudo- monas aeruginosa	gh P, et al., 2017; Pai C, et al., 2011)
Methanol extract fractioned with Dichloromethane (DCM)	ial parts of plant	9, 12-octadecadienoic acid ethyl ester (18.04%), 5-cholestane (12.42%), hexadecanoic acid ethyl ester (4.86%) and 9-octadecenoic acid ethyl ester (4.72%). Cholestane glycosides and rhamnosides are known for their potent cytotoxicity against malignant tumor cells	(Policegoudra RS, et al., 2014; Liu XT, et al., 2008)

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Table 3: Pharmacological properties of Tridax procumbens

Pharmacological property	Active against	Phytochemicals responsible for the activity	Extraction procedure	Reference
Antifungal activity	C. albicans	Phenols, flavonoids, saponins, sterols and fatty acids, puerarin, esculetin, oleanolic acid, betulinic acid, centaurein, bergenin and centaureidin. Bio-active compounds 9, 12-octadecadienoic acid ethyl ester, cholestane, hexadecanoic acid ethyl ester and 9-octadecenoic acid ethyl ester.	Methanol extract, Dilated Cardiomyopathy (DCM) fraction	(Policegou-dra RS, et al., 2014)
Antioxidant activi- ties	DPPH (1, 1-diphenyl, 2-pic-ryl hydrazyl)	Phenolics, proteins, vitamins, flavonoids, tannins, catechins and pectins	Ethyl acetate and n-Butanol	(Habila JD, et al., 2010)
Anti-inflammato-ry activity	COX-1 and COX-2	Centaurein and bergenin, flavonoids and other polyphenols	Ethyl acetate extract	(Jachak SM, et al., 2011)
Antibacterial activity	Staphylococcus aureus, Kleb-siella pneumoniae, Salmonel-la typhi, Escherichia coli and Bacillus cereus	Alkaloids, flavanoids, glycosides and other aromatic compounds	Methanol and ethyl acetate extracts	
Anti-cancer activity	Potent cytotoxic activity against malignant tumor cells	5α-cholestane, monoterpenes (alpha and beta pinenes)	Crude flower aqueous and acetone extracts,	
Hepatoprotective activity	Reduced levels of aspartate transaminase, alanine trans-aminase, alkaline phospha-tase, lactate dehydrogenase and gamma glutamyl trans-ferase) and bilirubin	Flavonoids, procumbenetin	95% Ethanol extract	(Ravikumar V, et al., 2005)
Immunomodula-tory activity	Humoral and cell mediated immune system	Triterpenoides and sesquiterpene	T. procumbens Ethanol Insol- uble Fraction (TPEIF) of the aqueous extract. EFTP (Ethyl Acetate Fraction) and NFTP (N Butanol Fraction)	(Tiwari U, et al., 2004)
	Sheep Red Blood Cells (SRBC) induced delayed type hypersensitivity reac- tions	Flavonoidal fraction and saponin fraction		

PHARMACOLOGICAL ACTIVITY:

1. Wound Healing (59)
2. Hepatoprotective (60)
3. Immunomodulatory (61)
4. Antidiabetic Activity (62)
5. Antimicrobial Activity (63)
6. Anti-Cancerous Activity (64)
7. Hypotensive (65)
8. Repellency Activity (66-67)
9. Anti-Urolithiatic Activity (68)
10. Hypoglycemic and Antihyperglycemic Activity (69)
11. Anthelmintic Activity (64)

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