REVIEW ON: MURRAYA KOENIGII – A BENIFICIAL HERB

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ABSTRACT
Murraya koenigii is a medium sized tree belonging to the family Rutaceae. It is native to Asia and is found throughout the Indian subcontinent. It is a popular remedy among the various ethnic groups. It is used as an analgesic, febrifuge, stomachic, carminative and for the treatment of dysentery and skin eruptions. Murraya koenigii is called as multipotential medicinal plants. Cure leaf, potent cancer warrior, sweet neem, Indian bay and vitamins power house are few of its popular names. The current review provides a detailed report of the importance of curry leaves, pharmacological activities, chemical constituents, morphological characteristics as well as up to date research study about Murraya koenigii leaves.

KEYWORDS: Murraya Koenigii, Multipotential, cure leaf.

INTRODUCTION
Curry leaf tree is an easy to cultivate herb and is indigenous to India and Sri Lanka, the countries of rich cultural heritage. Every part of this tree including its leaves, berries, and flowers has enormous medicinal values and the best part is that it is easily affordable to poor people as well.

Ayurveda calls this tree as girinimba or krishnanimba, named after lord Krishna, the god of ultimate protection.

1. Importance of curry leaf tree
Curry leaves are used in alternative medicinal practices like Ayurveda, unani, siddha and the traditional Chinese medicine for treating diarrhea, vomiting and to endorse the appetite. These leaves are known to possess anti-diabetic properties and are a popular natural aid for
controlling diabetes. The pastes extracted from the ground leaves are applied on wounds, eruptions, burns, acne and to treat other skin disorders.

Curry leaves boiled in coconut oil is popular natural tonic for hair growth. This herbal tonic is trusted to nourish hair follicles and restore its natural colour. It quenches thirst and suppresses the heat of the body, for which the yummy buttermilk flavored with curry leaves is often served to greet the guests in India. Certain ayurvedic remedies include the roots of curry leaf tree as an aid to relieve pain associated with kidneys. It also assists in treating inflammation, itching, anemia and other blood disorders known for its astringent properties, the fruits of the curry leaf tree are found to be nutritional and beneficial in the mythological medicines of ancient India and china.

The branches of the curry leaf tree are used since primordial times vastly in the field of oral care. It was used as a datum for cleaning the teeth and strengthening the gums by building a protective shield to battle against the harmful microbes.

2. Pharmacological activities of Murraya koenigii leaves.

*In vivo studies*

i. Vasodilating activity

ii. Antidiabetic property

iii. Hypocholesterotemic activity

iv. Antiulcer activity

v. Anti-diarrheal activity

vi. Phagocytic activity

vii. Analgesic and antinociceptive activity

viii. Anti-lipid peroxidative activity

ix. Radioprotective and chemoprotective activity

x. Antiamnesic activity

xi. Antihelminthic activity

xii. Memory enhancer

xiii. Wound healing activity

*In vitro studies*

i. Antimicrobial activity

ii. Antioxidative property
iii. Skin pigmentation
iv. Cytotoxic activity
v. Anti-tumor assay

3. Chemical constituents of Murraya koenigii with tested pharmacological activities.

<table>
<thead>
<tr>
<th>Sr. no</th>
<th>Constituent</th>
<th>Pharmacological activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Koenimbine</td>
<td>Anti-diarrhea</td>
</tr>
<tr>
<td>2</td>
<td>Murrayacine</td>
<td>Anti-microbial</td>
</tr>
<tr>
<td>3</td>
<td>Girinimbine</td>
<td>Anti-tumor</td>
</tr>
<tr>
<td>4</td>
<td>Koenimbidine/Koenidine/Koenigicine</td>
<td>Anti-diarrhea</td>
</tr>
<tr>
<td>5</td>
<td>Koenine</td>
<td>Anti-oxidant</td>
</tr>
<tr>
<td>6</td>
<td>Koenigine</td>
<td>Anti-oxidant</td>
</tr>
<tr>
<td>7</td>
<td>Mukonicine</td>
<td>Anti-oxidant</td>
</tr>
<tr>
<td>8</td>
<td>Mahanimbine</td>
<td>Cytoxicity</td>
</tr>
<tr>
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<td>Mahanine</td>
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<tr>
<td>10</td>
<td>Mahanimbinine</td>
<td>Antioxidant, Antimicrobial, Anti-diabetic and Hyperlipidemic.</td>
</tr>
<tr>
<td>11</td>
<td>Murrayacinine</td>
<td>Antioxidant, Antimicrobial, Anti-diabetic and Hyperlipidemic.</td>
</tr>
<tr>
<td>12</td>
<td>Isomahanimbine/mahanimbicine</td>
<td>Antioxidant, Antimicrobial, Antidiabetic</td>
</tr>
<tr>
<td>13</td>
<td>Mahanimboline</td>
<td>Cytotoxicity, Antioxidant, Antimicrobial, Anti-diabetic And Hyperlipidemic.</td>
</tr>
<tr>
<td>14</td>
<td>Isomahananine</td>
<td>Cytotoxicity, Antioxidant, Antimicrobial, Anti-diabetic And Hyperlipidemic.</td>
</tr>
<tr>
<td>15</td>
<td>Mukoeic acid</td>
<td>Antioxidant</td>
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<tr>
<td>16</td>
<td>Murrayanine</td>
<td>Antioxidant</td>
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<tr>
<td>17</td>
<td>Mukonine</td>
<td>Antioxidant</td>
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<tr>
<td>18</td>
<td>Isomurrayazoline</td>
<td>Antiamnestic, Immunomodulatory</td>
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<tr>
<td>19</td>
<td>Cyclomahanimbine or curryanine</td>
<td>Anti-inflammatory</td>
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<td>Murrayazolinine</td>
<td>Antileukemia</td>
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<tr>
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<tr>
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<td>23</td>
<td>Mahanimbinol</td>
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<td>Mukolidine</td>
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<td>26</td>
<td>Murrayanol</td>
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<td>Girinimbilol</td>
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<td>Koenoline</td>
<td>Cytotoxicity</td>
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<td>29</td>
<td>Glycozoline</td>
<td>Antifeedant</td>
</tr>
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</table>
4. Morphological characteristics

a. **Stem**: An aromatic and more or less deciduous shrub or a small tree up to 6m in height and 15 to 40cm in diameter. The main stem is dark green to brownish with numerous dots on it. Its bark can be peeled off longitudinally, exposing the white wood underneath.

b. **Leaves**: Green colour and characteristic odour and taste. Exstipulate, bipinnately compound, 30cm long, each bearing 24 leaflets having reticulate venation.

c. **Flowers**: Round to oblong, 1.4 to 1.6 cm long, 1 to 1.2 cm in diameter, weight 880mg, volume 895µL, fully ripe fruits, black with a very shining surface.

d. **Seed**: One in each fruit; 11mm long, 8mm in diameter, with spinach green color.

5. Up to date research study about Murraya koenigii leaves

1) **Effect of storage temperature on the nutritional value of curry leaf (2002)**

Researchers report a lower loss of β-carotene and apparently no loss of α-tocopherol and chlorophyll concentration in curry leaf frozen at -15°C compared to air drying or oven drying. However, the loss of lutein in the frozen samples was higher perhaps due to destruction of lutein during the freezing process. The loss of β-carotene, α-tocopherol and chlorophyll when air dried or oven dried may be attributed to loss of these compounds due to oxidation. Our results identify freezing at -15°C as an acceptable practical way of storing curry leaves. Air drying resulted in higher retention of vitamins β carotene and α tocopherol compared to oven-drying.

2) **Screening for anti-microbial activity and Phytochemical analysis of various leaf extract of Murraya koenigii (2011)**

It is concluded that the plant extract possess microbial activity against tested organism. The antimicrobial activity of the plants may be due to the presence of various active principles in their leaf.

3) **Antimicrobial efficacy of Murraya Koenigii spreng. Root extract (2011)**

The present investigation revealed that the various extracts from the roots of Murraya koenigii exhibited antimicrobial properties which explain the basis for its use in traditional medicines to treat skin infections. The methanol extracts exhibited significant inhibitory activity against pathogenic microorganisms. It showed maximum inhibitory effect against S.aureus and T. rubrum, bacterial and fungal strains respectively.
4) A review on Murraya koenigii: Multipotential medicinal plant (2012)
Researchers studied the pharmacological activities of Murraya koenigii and found that it possesses anti-diabetic, cholesterol reducing property, antioxidant property, antidiarrhoea activity, Cytotoxicity activity, antiulcer, antimicrobial, antibacterial potential and many more medicinal properties. Researchers concluded the fact that it is a popular remedy for various ailments.

5) Effect of carbazole alkaloids, essential oil and extract of Murraya koenigii in enhancing subcutaneous wound healing in rats (2012)
Absence of necrotic cells, lesion or shrinkage in cells of liver and kidney of the animals were observed, suggesting the non-toxic nature of the treatments using extract, Mahanine, mahanimbine, mahanimbicine and essential oil of Murraya koenigii. Therefore, the use of Murraya koenigii extract as wound healing agent could be useful as it protects the injury site from infections and rapidly increases the rate of connective tissue formation.

6) Assessment of quality of curry leaves (2013)
The researcher study suggests that the use of herbal medicine however, can be made relevant and popular after evaluating them for their quality, safety and efficacy. The researcher determined loss on drying, total ash value, acid insoluble ash, solubility, Melting point, pH, and heavy metals and concluded that Murraya koenigii can be used properly in pharmaceutical field because of its good quality and properties.

7) Curry leaf extracted in a 1:1 ratio of alcohol to water had the highest level of antioxidant properties, according to the findings of a study published in pub med (2013).

8) The scientist study suggests that Murraya Koenigii leaves to be a potent source of proteasome inhibitors that lead to cancer cell death. Therefore, identification of active components from the leaf extract could lead to the development of anticancer agents which could be useful in the treatment of different types of cancer (2013).

9) Curry leaves (Murraya koenigii Linn. Sprengal) – A miracle plant (2014)
Curry leaves is a leafy vegetable that belongs to the Rutaceae family. The chemical composition of the fresh leaves of Murraya koenigii consists of volatile oil carbazole alkaloids and triterpene have been isolated from stem bark and roots of Murraya koenigii. Thus, curry leaves merits, further Phytochemical, pharmacological and clinical investigations
for development of an effective natural remedy to provide therapeutically effective lead compounds.

From the available literature on Murraya koenigii reveals that the plant may be utilized to alleviate the symptoms of variety of diseases as evident form the pre-clinical data. Although crude extract from various parts of curry neem have numerous medical applications, modern drugs can be developed after extensive investigation of its bioactivity, mechanism of action, pharmaco-therapeutics, toxicity and after proper standardization and clinical trials. The available literature and wide spread availability of Murraya koenigii in India thus makes it an attractive candidate for further pre-clinical and clinical research. Murraya koenigii is a Multipotential medicinal plant. Almost each and every part of the plant has numerous medical applications. Thus it can be consider being a most suitable candidate for new drug discovery.

CONCLUSION
From the available literature on Murraya koenigii reveals that the plant may be utilized to alleviate the symptoms of variety of diseases as evident from the pre-clinical data.

Murraya koenigii is a Multipotential medicinal plant. Almost each and every part of it is important. Murraya koenigii is a traditional Indian Ayurvedic herb. Apart from being a useful food supplement in curries and chutneys, the herb possesses immense therapeutic potential. The therapeutic usefulness of the herb can be easily understood from the present review.

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