

Maerua oblongifolia – What do we really know?

Overview, Progress and Perspectives

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Abstract: Nature is the most powerful and beautiful creation. The major part of nature was created by plants. The plants are designed with a specific purpose such as food, medicine etc., Plants are the only source for treatment and prophylaxis until 16th century. India perhaps the large producer of herbal plants and currently called as the “Botanical garden of the World”. Herbal medicines are getting significant importance globally in treating various diseases. *Maerua oblongifolia* is one of the most commonly used plants to cure various diseases like stomach ache, urinary calculi, diabetes, fever, skin infections, epilepsy, pruritis, cough, abdominal colic. Hence, it is necessary to have proper a scientific evaluation on *Maerua oblongifolia* to identify its medicinal values. Traditionally and commercially, *Murva* is used to prepare so many herbal formulations but still research has to show the scientific evidence is needed to prove its enormous medicinal properties. In present paper detailed taxonomic description, photographs, botanical characters, pharmacological activity and its phytochemical contents are discussed.

Keywords: Herbal medicines, *Maerua oblongifolia*, *Murva*, Phytochemical constituents, Pharmacological activity.

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I. INTRODUCTION

Nature is the most powerful and beautiful creation. The major part of nature was created by plants. The plants are designed with a specific purpose such as food, medicine etc., apart from their physical and external beauty, the chemistry inside the plants is most important to mankind because they are life-sustaining force on earth. Jethro Kloss, a naturopath, states that there is a wonderful science in nature, in trees, herbs, roots and flowers which man has fathomed. At the stage of early man, Homo sapiens are the first people who found that plants have that healing property, but they don't have detailed information of which plant has healing properties and how to use those plants for the treatment. Later, they discovered the plant with specific properties for the particular treatments. Thus the usage of plants for treatment gradually increased. But in 16th century, iatrochemistry (Iatros means a physician or medicine in Greek words), a combined branch of chemistry and med-

-icine came into existence and introduced the use of synthetic drugs [1].

Plants are the only source for treatment and prophylaxis until 16th century. India perhaps the large producer of herbal plants and currently called as the “Botanical garden of the World”. In India, from three thousand years onwards ayurvedic systems of medicine have been existing. The two great Indian scholars namely, *Charaka* and *Sushruta* have had sufficient knowledge on the properties of medicinal plants especially in India. The detailed description of the herbal medicines were included in the Vedas in the form of epic poems at that time. The two medicinal treatises namely, *Charaka samhita* and *Sushruta samhita* were worshipped even to date as the treasures on indigenous medicine [2]. Traditional medicine is the sum total of knowledge, skills and practices based on theories, beliefs and experiences indigenous to different cultures. Therapeutic potentials of

herbal drug ranges from plant to plant, through simple extracts to isolated active constituents. Traditional medicines are not only used for primary health care but also used to treat various diseases which cannot be cured by allopathic medicine. Our Indian traditional medicine (Ayurveda) attaining prominent importance in the medical field due to following advantages over allopathic medicines:

- The main advantage of ayurveda is, it has no or very less side effects as the ayurvedic formulations are prepared from the natural species like leaves, roots, fruits and natural herbs.
- Apart from its no side effect therapy, it also has capacity to cure so many dangerous diseases where allopathy fails to cure.
- Ayurvedic treatment is time taking process, as the formulations contains very less amount of active ingredient and that is the reason why the ayurvedic medications are not having any side effects.
- These formulations are environment friendly as those are prepared from organic materials.
- The most important thing of Ayurveda is, it targets the root cause of the disease, and penetrates deep into the body and clears the disease causing pathway.
- The ayurvedic formulations are cost effective compared to allopathic medications as these are made from natural ingredients [3].

Herbal medicines are getting significant important globally. 80% of African population is using some of the herbal medications to treat various diseases and the annual market for herbal products had reached US\$60 billion. The world health organization had reported that, the investments on herbal medical research are increased from US\$ 33 million in 2005 to US\$ 100 million in 2006 [4]. It has been estimated that world's 60-80% population rely on traditional herbal health care. World health organisation has developed and issued a series of technical guidelines such as "Guidelines for assessment of herbal medicines" and "Research Guideline" for evaluating the efficacy and safety of herbal medicines [5]. In the early part of 20th century there started an evolution for the development of chemical techniques and laid a foundation stone for the pharmaceutical industry. However, in recent years, there is a renaissance of interest in learning and use of medicinal plants [6].

As there are many side effects occurring with the synthetic drugs, researchers are focusing on our ancient Indian traditional plants. Re-search meaning again search, the same thing is happening here too because we are focusing on our ancient Indian traditional plants what our ancestors had used and trying to prove their beliefs like those plants had that capacity to treat such ailments. In this case, out of so many traditional plants which processes biological activity we selected "*Maerua*

oblongifolia" based on Ethanomedical survey which reveals that the plant is used to cure various diseases such as urinary calculi, stomach ache, diabetes, fever, epilepsy, pruritis, skin infections, cough, abdominal colic etc., [7]. The well-known traditional systems of medicine namely Ayurveda and Siddha existing in the country for centuries which includes many medicinal plants used as crude drugs in the formulations. Unfortunately the literature of this plant in the famous classics like *Charakasamhita*, *Sushrutasamhita* are insufficient for the proper understanding of these drugs in the present day context. Consequently many drugs used in Ayurveda are categorized as "Controversial drugs". Hence, it is necessary that a proper scientific evaluation is required for *Maerua oblongifolia*.

Maeru oblongifolia plant description [8]

Classification:

Kingdom	Plantae
Order	Brassicales
Family	Capparaceae
Genus	Maerua
Species	<i>M. oblongifolia</i>

Vernacular Names:

English	Necklace Berried Caper
Hindi	Hemkand, Potiakand, Wagboti
Telugu	bhoochakra gadda, merupu theega, putta tige
Kannada	bhoochakra gedde, nela sakre gedde
Tamil	Bhumichakkarai
Sanskrit	madhusrava, morata, murahari, pipluparni
Gujrat	Hemkand, Kala-pinjola
Punjab	Pilwani
Rajasthan	Orapa
Marathi	hemakand, kaatigolo, virat
Tibetan	ro ma ha
Unani	Harasingaar

Botanical description of *Maerua oblongifolia*

Plant: It is a type of woody climber which climbs over *Maytenus emarginata*, *Prosopis cineraria*, *Tecomella undulata*, *Salvadora* spp [9]. It is an under shrub bushy plant sometimes scandent 2-3 m high with pale brown smooth bark and consists of thick root stock and leaves [10].

Flowers: Plant produces aromatic flowers especially during summer seasons. They are strongly scented and greenish-yellow or greenish-white in color, and are arranged in axillary and terminal corymbs. Calyx lobes to

1.2 cm long. Corolla lobes 6 to 7 mm long [9-10].

Fruits: Type of fruit is Moniliform berry. There are numerous variations in morphology and fruit size, the fruits are pale-brown in color with 8-12 cm long, forming an elongated, knotted and twisted one seeded berry. The sugar and sweet content is rich in ripe fruits [9].

Leaves: The plant consists of elliptic-obtuse leaves with a pointed end at the apex [10]. The leaves are petiolate, simple or 1-3 foliolate, stipules are minute and subulate [11].

Root: The plant consists of thick root stock which tastes like coconut pulp, and is eaten with sugar [12]. The root goes deep into the soil which consists of a very stout tap root. It is slender, woody, and shaped irregularly. The roots are slightly yellowish with coconut pulp taste with diameter ranges from 1-9 cm. The surface of the fresh roots is brownish, smooth with concentric deep furrows and is very soft to touch. Dry roots are dark brown in colour (outside) whereas pale yellow in color (inside). Dry roots are the one which form the drug of commerce, very hard, fracture brittle and are occurs in small pieces of 2-4 cm long. The transverse section of the young root consists of cork, secondary cortex and stellar region. The central woody part is yellowish in color. The outer stellar region consists of several concentric arranged vascular bundles due to anomalous secondary growth. Cork is the outermost layer covered by thick and dark colored rhytidome. It consists of 8-10 layers of thick walled rectangular cells followed by secondary cortex which consists of multi layered parenchymatous cells, this cells consists of oil globules, rhomboidal or prismatic type of calcium oxalate crystals and simple starch granules. Stone cells occur in groups and transverse tangentially. Vascular bundles are arranged concentrically in a broad outer stellar region and they lie embedded in parenchymatous conjunctive tissue. This is followed by central woody inner stellar region which is made up of secondary xylem and secondary phloem. Medullary rays are multi seriate; cells are parenchymatous [13].

Geographical Distribution:

M. Oblongifolia is native to India and widely distributed in different states as follows:

- In Andhra Pradesh: Kadapa, Kurnool, Anantapur, Vishakapatnam district.
- In Karnataka: Ballari district
- Maharashtra: Forest area
- Orrisa: Khurda, Ganjam, Puri district
- Tamilnadu: In Hilly regions of various district

M. Oblongifolia also distributed in other countries like Thailand, Sri Lanka, Pakistan, Arabia, Middle East and Africa [14]. Physicochemical parameters of *M.Oblongifolia* tuber has been tabulated in table 1.

Table 1: Physicochemical parameters of *M. oblongifolia* tuber [15]

S.No	Parameters	Value (%)
1.	Loss on drying at 105° C	12.42
2.	Total ash	8.28
3.	Acid-insoluble ash	1.73
4.	Water soluble extractive	16.73
5.	Alcohol soluble extractive	8.73

Phytochemical Constituents of *M. oblongifolia*:

Abdel-Mogib M (1999), had done research to investigate the phytochemical constituents present in the aerial parts of plant namely, *M. oblongifolia* using chromatographic studies. In his study, he found that, the chromatographic extract consists of isothiocyanate glycosides, 2 linear triterpenoids (figure 1a); 3 lupane triterpenoids (figure 1b); 6 fatty acid derivatives namely, palmitic acid, stearic acid, oleic acid, palmitoleic acid, linoleic acid and methyl ester of palmitic acid, stearic acid, oleic acid, linoleic acid, these methyl esters are formed due to methanolysis of fat material during extraction; 2 (29)-en-3 β , 30-diol [16].

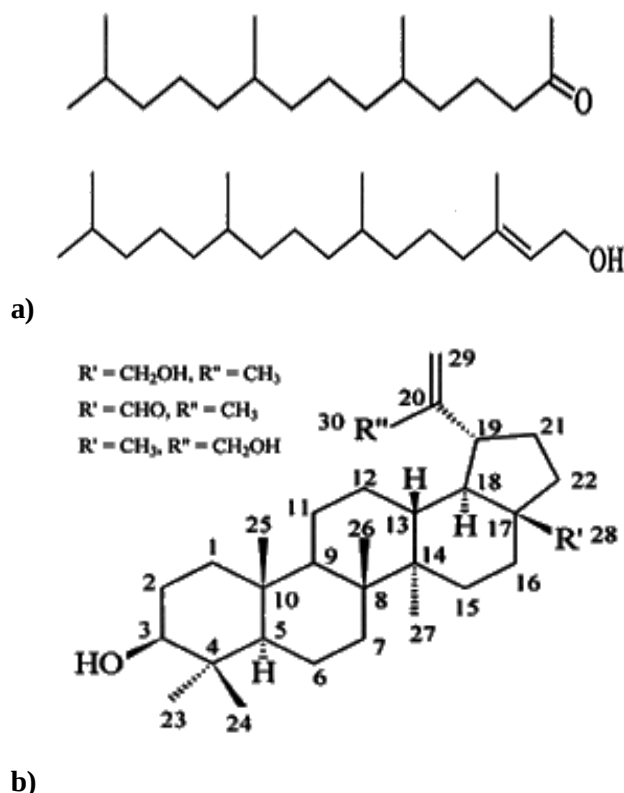


Figure 1: Phytochemical constituents of aerial parts of *M. oblongifolia*. a) 2D structural representations of linear triterpenoids. b) 2D structural representations of Lupane triterpenoids.

Desta Ekero et al., 2018 worked on crude extracts of leaves of *M. oblongifolia* for screening of pharmacological and biological activity. He extracted air dried leaf powder of *M. oblongifolia* with methanol at room temperature. Then he subjected the extract to fractionation using column elution and collected 32 fractions. With the help of TLC and other spectroscopic methods, he isolated and characterized the new chemical constituent namely MOM-19 which is a triterpene [10].

Arulanandraj N et al., 2011 had observed that 8 peaks were present, and those 8 peaks correspond to different phytochemical constituents from aqueous and alcoholic extract of *M. oblongifolia* using HPTLC. HPTLC profile of aqueous extract of *M. oblongifolia* had shown 8 peaks at 366nm and 6 peaks at 425nm, whereas the alcoholic extract of *M. oblongifolia* had shown 8 peaks at 254nm, 3 peaks at 366nm and 425nm [7].

Madhavan V et al., 2013 had done pharmacognostic and phytochemical studies on the roots of *M. oblongifolia*. In her phytochemical investigation of the ethanol extract of the root, she found the presence of alkaloids, phytosterols, saponins, whereas in the aqueous extract of the root, she found the presence of alkaloids, carbohydrates and glycosides, saponins, proteins and amino acids [13].

Savithamma N et al., have done qualitative phytochemical analysis for various plants along with this *M. oblongifolia* and had reported the presence of various phytochemicals such as saponins, terpenoids, steroids, anthocyanins, coumarins, fatty acids, tannins, leucoanthocyanins and emodins [17].

In Indiamike.com (2019) website, the author mentioned different studies related to *M. oblongifolia*. One study revealed that the petroleum ether extract contained phytosterols, fixed oils and fats [18].

Traditional uses

Traditionally, the root is mostly used to treat several diseases like fever, diabetes, epilepsy, piles, typhoid, sterility, stomach ache and some skin diseases. The Murva which is obtained from the root of the plant and is used in several ayurvedic formulations. Apart from this, numerous articles describes various traditional uses of *M. oblongifolia* which are mentioned below:

- Rajagopal Reddy. S et al., (2019) had described that the gum paste of this plant can be applied for dog bite [19].
- Ratna Raju. Y et al., (2014) in his documentation of Ethanomedicinal plants of Hilly tract areas of East Godavari district revealed that, the raw root bulb along with pepper was taken orally to treat diabetes [20].

- The tubers and roots of this plant are found to be used in general debility and aphrodisiac [21].
- The article namely, Root of Relief published in Telangana Today had explained that, the consumption of the root will helps in purifying the blood and keeps the body cool. The article also revealed that, the root has the capacity to cure diabetes and inflammatory diseases like arthritis, for these reasons the root has huge demand in public in which the sellers sell the root for 600/- per kilogram [22].
- Daily intake of 100-150 grams of root tuber along with jaggery will acts as energy stimulant [23].
- The fleshy roots were used for treating of snake bites and scorpion stings and the root is used as alternative tonic and stimulant [24].
- Mohamed. I.E.T et al., 2010 had mentioned that, the plant is used to treat Hypocholesterolaemia, malaria, abdominal pains and used as astringent [25].
- The roots are used as stimulant and the extract of the root is used to treat convulsions and epilepsy [26].
- The paste of the crushed root is used to treat cough and cold in children especially by applying the paste over the chest region [27].
- The paste of the stem of this plant is used to treat skin diseases and also to cure leucorrhea whereas the entire plant sap is used in blood purification [28].
- The leaf is crushed and homogenized in water and then the water is taken orally to facilitate digestion and used to treat stomach ache and abdominal pains [29].
- The gall part of this plant is used to treat asthma and some skin diseases [30].

Pharmacological activity: Anti-pyretic activity

Madhavan. V et al., 2010 used aqueous and alcoholic extract of *M. oblongifolia* to study anti-pyretic activity using Wistar albino rats by yeast inducing pyrexia. The results had shown that, within 30 min of their administrations the aqueous and alcoholic extracts had reduced the elevated rectal temperature in febrile rats. But, the maximum temperature reduction was observed at 120 min when compare with significant recording timings of post administration. However, there is reduction in elevated rectal temperature in Wistar albino rats. Hence, it is proved that, the *M. oblongifolia* possess anti-pyretic activity [31].

Anti-fungal activity

Baka, Z. (2010). have worked on six Saudi medicinal plant extracts against five phytopathogenic fungi. The results of his work shown that the aqueous

extract of the leaves of *M. oblongifolia* is able to inhibit the mycelial growth by 36.9% and spore germination by 69.1% of the following fungi species such as *A. solani*, *B. fabae*, *A. brassicae*, *F. oxysporum* and *P. infestans* and stood in 2nd place when compare to all 6 plants which he used in his study. On the basis of this study, we conclude that, the *M. oblongifolia* possess anti-fungal activity [32].

Anti-microbial activity

Van Vuuren, S. (2006) have prepared different toothbrush from different plant species of plants along with *M. oblongifolia* plant and screened for its efficacy against Gram positive bacteria (*Bacillus cereus*, *Streptococcus mutans*, *Lactobacillus acidophilus* and *Staphylococcus aureus*), Gram-negative bacteria (*Escherichia coli* and *Klebsiella pneumoniae*) and two yeasts (*Candida albicans* and *Cryptococcus neoformans*) to establish scientific evidence for the use of those toothbrush to maintain oral hygiene. The anti-microbial activity was tested by using minimum inhibitory concentration assay. The results have shown that, the prepared toothbrushes have shown moderate to good anti-microbial activity and the *M. oblongifolia* plant extract tooth brushes stood at 2nd position out of all plant extract tooth brushes which he used in his study [33].

Chemotaxonomic activity

Hamand. MS et al., (2017) have done experiment to study chemotaxonomic relationship between phenolic components of the roots for selected species of same family (Capparacea). The ethanol extract of the roots were used in the study and by using thin layer chromatographic technique (mixture of toluene-chloroform-acetone) he separated the phenolic compounds. Based on the roots phenolic compounds, the paired affinity was constructed. *M. oblongifolia* and *Schimpera arabica* pair had exhibited highest affinity [34].

Aphrodisias activity

Koteswara Rao. J et al., (2018) have done Ethanomedicinal survey on the plants used by the tribes of North Coastal Andhra Pradesh and found 45 species of plants which can be used for aphrodisiac. Out of 45 species of plants, he reported *M. oblongifolia* and *Zaleya decandra* as new and less known medicinal species. For the treatment, the dried root bark powder (a pinch) is mixed with half spoon of honey and administered once a day for 2 months. Based on the survey, it was clear that the traditional plant (*M. oblongifolia*) has aphrodisiac activity [35].

Anti-microbial activity

Moglad. E et al., (2014) have done research on *M. oblongifolia* to discover anti-bacterial and anti-fungal activity. The stems and leaves of the plant are subjected for maceration using 80% ethanol and chloroform for 5 days at room temperature. Then, the extract was screened for anti-microbial activity against gram positive bacteria such as *Staphylococcus aureus* and *Bacillus subtilis*, gram negative bacteria such as *Escherichia coli* and *Salmonella typhi* and fungi such as *Aspergillus niger* and *Candida albicans*. The anti-microbial activity is measured through minimum inhibitory concentration assay. The zone of inhibition is ranging from 13-20 mm indicating that the extract had shown inhibitory activity against most of the organism. Overall, the methanol extract of the stem had shown largest zone of inhibition over *Aspergillus niger* and the chloroform extract of the stem had shown largest zone of inhibition against *Escherichia coli*. He also had done in vitro cytotoxicity studies using MTT assay and 3T3 NIH mouse embryo fibroblast cell line and a rat Wistar hepatocyte cell line. This assay revealed that the extract of *M. oblongifolia* has non-toxic effect on 3T3 NIH mouse embryo fibroblast cell with less than 20% of growth inhibition. Hence, from this study it was found that *M. oblongifolia* has anti-microbial activity along with some cytotoxic property [12].

Wound healing effect

Arulanand Raj. N et al., (2018) used *M. oblongifolia* to study wound healing activity using albino rats. *M. oblongifolia* plant powder was extracted with ethanol using soxhlet extractor. The extract at concentration of 2.5%w/v was used for the experimentation and the extract at 2.5 % w/v concentration healed the wound in 15 days and the wound healing capacity of this extract is compared with soframycin ointment and better results were observed with this plant extract. Hence, based on this study it revealed that *M. oblongifolia* has wound healing property [36].

Anti-convulsant activity

Sundara. K, Madhavan. V., 2019 had investigated the anti-convulsant activity of *M. oblongifolia* using albino mice. For this purpose, they had done two extractions, one is off ethanol extract and another one is aqueous extract and for the extraction, they used root powder. The anti-convulsant activity was evaluated in Swiss albino rats by employing Maximal Electrical shock (MES) and Pentylene tetrazole (PTZ) induced seizures. So, the results were shown that, both ethanol and aqueous extracts of *M. oblongifolia* root at the concentration

around 200 and 400 mg/kg had reduced the extensor phase and the recovery time in MES induced seizures whereas in PTZ induced convulsions both extracts at different doses had delayed the onset of convulsions and reduced the recovery time. Hence, from this study it was identified that, the plant also possess anti-convulsant activity [37].

Anti-diabetic activity

Arulanandraj. C. N et al., had done research on *M. oblongifolia* to find anti-diabetic activity using alloxan induced Swiss albino mice. In his study, he used the aqueous extract of the root at the concentration of 800mg/kg had showed significant reduction in blood glucose levels than the standard drug glibenclamide. So, this study states that, the *M. oblongifolia* root also acts as potent anti-diabetic drug [38].

II. CONCLUSION

Maerua Oblongifolia is an important ayurvedic plant used in many ayurvedic formulations. *Murva* is the main constituent of this plant which is used to treat various diseases like stomach ache, urinary calculi, diabetes, skin problems, epilepsy and fever. Traditionally and commercially, *Murva* is used in to prepare so many herbal formulations but still research is needed as it has no scientific evidence to prove its enormous medicinal properties.

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REFERENCES

- Petrovska, Biljana Bauer. "Historical review of medicinal plants' usage." *Pharmacognosy reviews* 6.11 (2012):15-17.
- Adhikari, Partha Pradip and Satya Bhusan Paul. "History of Indian traditional medicine: A medical inheritance." *HISTORY* 11.1 (2018):421-25.
- Nair D. Benefits of Ayurveda over Allopathy (Case Study) – Jeevana [online] (2019): Available at: <https://www.jeevana.in/2014/01/30/benefits-ayurveda-allopathy>.
- Who.int. WHO | Herbal medicine research and global health: an ethical analysis. [Online] (2019):Available at: <https://www.who.int/bulletin/volumes/86/8/07-042820/en>.
- Sharma, P. C., M. B. Yelne, and T. J. Dennis. "Database on medicinal plants used in Ayurveda." (2005): 420-440.
- Singh, V. K., J. N. Govil, and Gurudip Singh. "Recent progress in medicinal plants. Vol 1: Ethnomedicine and pharmacognosy." *Recent progress in medicinal plants. Vol 1: Ethnomedicine and pharmacognosy*. 201 (2002): 25-27.
- Arulanandraj, N., et al. "Nanotechnological approach to enhance the stability and bioavailability of the herbal drug" *murva*." *Journal of Drug Delivery and Therapeutics* 8.5 (2018): 251-256.
- Plantekey.com. Plantekey | Auroville Botanical Garden. [Online] (2019): Available at: <http://plantekey.com>.
- Rathore, Mahender Singh, and Narpal Singh Shekhawat. "Micropropagation of Maerua oblongifolia: A rare ornamental from semi arid regions of Rajasthan, India." *J Dev Biol Tissue Eng* 3.8 (2011): 92-98.
- Ekerö D, Legesse M, Lelago A., Agize M. Extraction, Isolation and Characterization of Maerua oblongifolia ('Sanagana'). *Int J Curr Res Biosci* 5.3 (2018):42-48.
- Bhalakiya H, Nainesh RM. A Comprehensive Review on Maerua Oblongifolia (Forsk.) A. Rich". *Int J Res Adv Tech* 7.4 (2019): 232-37.
- Moglad, E. H. O., et al. "In vitro antimicrobial activity and cytotoxicity of Maerua oblongifolia." *Int J Med Med Sci* 1.3 (2014): 32-37.
- Madhavan V, Munisamy U, Yoganarasimhan, S, Gurudeva M, Deveswaran R, Saravanan. Sundara, et al., Madhavan, Varadharajan, et al. "Pharmacognostical studies on the roots of Maerua oblongifolia (Forsk.) A. Rich.(Capparaceae)." *Asian Journal of Traditional Medicines* 7.1 (2012):29-38.
- Flora of Peninsular India. [Online] (2019):Available at: <http://flora-peninsula-indica.ces.iisc.ac.in>
- Siddhacouncil.com. [online] (2019):Available at: <http://siddhacouncil.com/AR13-14.pdf>.
- Abdel-Mogib, M. "A lupane triterpenoid from Maerua oblongifolia." *Phytochemistry* 51.3 (1999): 445-448.
- Savithramma, N., M. Linga Rao, and D. Suhrulatha. "Screening of medicinal plants for secondary metabolites." *Middle-East Journal of Scientific Research* 8.3 (2011): 579-584.
- India Travel Forum | IndiaMike.com. [Online] (2019): Available at: <https://www.indiamike.com/india/indian-cooking-and-cuisine-f12/fruits-of-india-t57159/17>.
- Reddy, S. Rajagopal, A. Madhusudhana Reddy, and MV Suresh Babu. "Traditional Medicinal Plants of Lankamalleswara Wildlife Sanctuary, Kadapa District, Andhra Pradesh, India." *American Journal of Ethnomedicine* 2.6 (2015): 2348-9502.
- Raju, Y. RATNA, P. Yugandhar, and N. Savithramma. "Documentation of ethnomedicinal knowledge of hilly tract areas of east Godavri district of Andhra Pradesh, India." *Int J Pharm Pharm Sci* 6 (2014): 369-374.
- Shodhganga.inflibnet.ac.in. [online] (2019): Available at: https://shodhganga.inflibnet.ac.in/bitstream/10603/61112/7/07_chapter%201.pdf.
- Santosh P. Root of relief. [Online] (2019): Telangana Today. Available at: <https://telanganatoday.com/root-of-relief>.
- Savithramma N, Yugandhar P, Prasad K, Ankanna S, Chetty K. Savithramma, Nataru, et al. "Ethnomedicinal studies on plants used by Yanadi tribe of Chandragiri reserve forest area, Chittoor district, Andhra Pradesh, India." *Journal of intercultural ethnopharmacology* 5.1 (2016): 49-53.
- Revolvy, L. "Maerua oblongifolia" on Revolvy.com. [Online] (2019): Available at: <https://www.revolvy.com/page/Maerua-oblongifolia>.
- Mohamed, Ietidal El Tahir, and Mahasin El Nur Abdelrahman. "The antibacterial, antiviral activities and phytochemical screening of some Sudanese medicinal plants." *EurAsian Journal of BioSciences* 4.1 (2010): 8-16.
- Thakor, ALPESH B. "Economical uses of plants by tribals from Valsad district of Gujarat, India." *International Journal of Agricultural Sciences* 5.2 (2009): 611-614.
- Punjani, B. L., and Vivek Kumar. "Traditional medicinal plant remedies to treat cough and asthmatic disorders in the Aravalli

- ranges in North Gujarat, India." *Journal of Natural Remedies* 2.2 (2002): 173-178.
28. Patel, Y. S., E. P. Joshi, and P. N. Joshi. "Ethnobotanical study of Tapkeshwari Hill, Bhuj, Kachchh, India." *Life Sci Leaflets* 2 (2010): 22-31.
 29. Meragiaw, Misganaw. "Wild useful plants with emphasis on traditional use of medicinal and edible plants by the people of Aba'ala, North-eastern Ethiopia." *J Med Plant Herb Ther Res* 4.1 (2016): 1-16.
 30. Al-Fatimi, Mohamed, et al. "Antioxidant, antimicrobial and cytotoxic activities of selected medicinal plants from Yemen." *Journal of ethnopharmacology* 111.3 (2007): 657-666.
 31. Madhavan V, Amit Kumar Shukla A, Anita M, Usha M, Yoganasimhana SN. Antipyretic activity studies of two botanical sources of the drug Murva. *Asian J. Tradit. Med* 5.5 (2010):115-20.
 32. Baka, Zakaria AM. "Antifungal activity of six Saudi medicinal plant extracts against five phytopathogenic fungi." *Archives of Phytopathology and Plant Protection* 43.8 (2010): 736-743.
 33. Van Vuuren, S. F., and A. M. Viljoen. "The in vitro antimicrobial activity of toothbrush sticks used in Ethiopia." *South African Journal of Botany* 72.4 (2006): 646-648.
 34. Hamad, Mubarak Siddig, Ahmed Saeed Kabbashi, and Ikram Ahmed Madani. "Chemtaxonomic Relationship of Roots Phenolic Compounds for Selected Species of Four Families Recently Grouped in Brassicales by APGIII." *World* 2.4 (2017): 140-144.
 35. Rao, Jarra Koteswara, and T. V. V. Reddi. "Ethnomedicine for aphrodisiac by the tribes of North Coastal Andhra Pradesh." *Indian Journal of Natural Products and Resources (IJNPR)[Formerly Natural Product Radiance (NPR)]* 9.3 (2018): 267-272.
 36. Arulanand Raj N, Gopal V, Dhivya S, Jayabalan G. "Evaluation of wound healing effect of *Maerua Oblongifolia* in albino rats". *World J Pharma Res* 8.1 (2018):1380-1385.
 37. Sundara KS, Madhavan V. "Anti-convulsant activity of ethanol and aqueous extract of *Maerua Oblongifolia* (Forsk.) A. Rich. Root in albino mice". *Int. J Pharm Sci Rev Res* 8.1 (2016):46-49.
 38. Arulanandraj, C. N., T. Punithavani, and S. Indumathy. "Effect of murva (*Maerua oblongifolia*) on alloxan induced diabetes in rats." *International Journal of Pharmaceutical Sciences and Research* 2.10 (2011): 2754.

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