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A Comprehensive Review on its Physiological, Ecological, Phytochemical and Pharmacological Perspectives of Neolamarckia Cadamba

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Abstract: *Research on Neolamarckia cadamba, or "kadam", has been in trend till now; considering its various immunomodulatory, anti-microbial, anti-diabetic, anti-oxidant, and other medicinal properties. It can be useful in developing various preventative therapies and disease-curing strategies around the world. Even though profound research investigations have been conducted on Neolamarckia cadamba, or "kadam", for its use in ailment treatments, a wise understanding of the physiological, ecological, phytochemical, and pharmacological behaviour of "kadam" has to be addressed. This paper presents a comprehensive survey of various studies that have been reported on physiological, ecological, phytochemical, and pharmacological behaviour with the same objective. This review will provide researchers with a clear onset of the importance of medical values discovered in the cadamba plant.*

Keywords: Neolamarckia cadamba, Physiological, Ecological

I. INTRODUCTION

The tropical tree Neolamarckia cadamba Miq popularly known as kadam, is endemic to the South and Southeast asia, particularly Indonesia. Although Kadamba has a bitter, pungent, and astringent flavour called rasa, along with a pungent post-digestive impact known as vipaka, it balances all of the doshas, especially kapha and pitta. As reported by Slik (2006), the production of cadamba in Indo- nesia has been very widespread for many years ago,
around the 1930s. The plant has been grown in Java, west and east of Kalimantan, Sulawesi, Sumbawa, and Irian Jaya worldwide (Martawijaya et al., 1989). In India, kadamba is a plant that grows all over the country. Predominantly, it is found in India's sub- Himalayan region, stretching from one side to Nepal, another side to West Bengal and Assam. It can also be seen in some northern and south-eastern regions of India like Bihar, Chhattisgarh, Madhya
Pradesh (MP), and Andhra Pradesh (AP). In other Indian states like Karnataka and Kerala, it is a part of evergreen forests (Selvan and Parthiban, 2018). Neolamarckia cadamba is found in Uttarakhand's Haldwani Division, where it grows on the damp and swampy ground (Osmaston, 1927), in southern tropical semi-evergreen forests, in northern tropical wet deciduous forests, and in tropical freshwater swamp forests in the tropics (Champion and Seth, 1968). Which numerous species of this tree are widely planted in India, especially in agroforestry by farm-forestry method.

II. RESEARCH METHODOLOGY

The research methodology for the present comprehensive literature survey is described in this section. The present review methodology consists of three different phases, which include planning, executing, and documentation. The planning further consists of three different steps. The first step in planning is determining the need for the review; the second is formulating research questions; and the third is analyzing the physiological, ecological, phytochemical and pharmacological actions of the "cadamba plant". The various research articles based on macro and microscopic studies have been investigated as part of methodologies analysis. In the executing phase, the author searched for articles relevant to the area, screened articles based on the year of publication, and performed a quality assessment based on the articles' findings. The datasets or research articles that have been selected for this review are from Scopus, PubMed, and Web of Science journals, published in the last few years. Physiology while exploring its physical aspects,

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Neolamarckia cadamba is overall a big tree with a wide crown in the shape of umbrella and a cylindrical bole. The arms or branches of the tree are organised in tiers. It usually grows to moderate size of 15-20cm and has a rounded crown. But kadambas may have a maximum height of 45 metres, with 100 to 160 cm stem's diameter and a little buttress up to 2 metres high. The branches are horizontally extended, arranged in tiers and simply terminate at the tip. Its bark is deep grey with longitudinal fissures and thin scales that exfoliate. The leaves are oval in shape with pronounced veins measuring around 30*30 cm in length and width similar to those of madhuka. The flowers are small, orange, and globose in shape. The fruit is usually seen as fleshy, small capsulated structure which form yellowish-orange infructescence which contain nearly 7000 seeds. Further, the mature fruit is spherical, firm and yellow in colour with a sweet and tart flavour. Seed are trigonal or irregular in shape. If primarily discussing its wood characteristics, it has lightweight wood and is hard in strength. This heartwood is white with a yellow hue that darkens to creamy yellow when exposed, and it isn't easy to distinguish it from sapwood (Martawijaya et
al., 1989). Other characteristics of this wood include having a fine or moderate texture, a straight grain, and a low gloss, with no distinct odour or flavour. Also, the wood of the "cadamba tree" is very useful for various mild construction materials such as floors, shafts and rafters, boxes and crates, teachests, etc. The most crucial factor in cadamba's survival is light. The highest temperature in its natural habitat ranges from 32 °C to 42 °C, while the lowest temperature varies between 3 °C to 15.5 °C. Frost is a problem for Neolamarckia cadamba. For its growth, there is a need for the average yearly rainfall to vary from 1500 to 5000 mm. Few cadamba trees may flourish locally in considerably drier locations with annual rainfall as low as 200 mm in various central regions of South Sulawesi. The ideal growing altitude for this tree is between 300 and 800 metres above sea level.

Ecology

While discussing the ecological behaviour of "Neolamarckia cadamba" distinctively, it is observed that it is a peculiar species that prefer deep and wet alluvial soils and is frequently seen in secondary woods along banks of rivers and the transitional zone between marshy, constantly flooded. Soil condition plays a crucial role in its yield as it grows on a vast range of soils, but it thrives mainly on well accelerated fertile soils, which are more plentiful and dominant. Even though the physical conditions are ideal, sometimes it does not thrive in leachable or inadequately aerated soils, as mentioned by Jansen et al. (1993). Furthermore, seeds are sown in the month of February after mixing them with sterilized sand. Sowing in the winter season has been found to be least successful. And after the sowing process, watering is done which is followed by germination in about 2-3 weeks. Generally, sowing in A. cadamba occurs at the age of 5 in planting circumstances.

Somewhere around the age of four, the tree begins to bloom. Flowering lasts about 2–5 months on average and months of flowering varies from region to region depending on their climatic condition. Flowering occurs in Indonesia from April to August, while the fruits mature between sixth (June) to eighth (August) month of the year (Martawijaya etal., 1989). Onset time for flowering and fruiting of the tree differ for different nations.

Biological and medicinal significance of Neolamarckia cadamba

The Cadamba, highly known for its medicinal properties, is an important member of family Rubiaceae. The plant is rich in secondary metabolites and several phytochemicals such as cadambagenic acid, âsitosterol, cadamine, cadambine, quinovic acid, etc. Which have significant role to play in nature due to its biological and pharmacological characteristics. Also, it can be put to use as a substitute to different synthetic compounds for the prevention and cure of several iseases. More than 10 decades took to discover different phytochemicals and their implications. Furthermore, the Cadamba has its unique ornamental value together with religious significance. The use of Neolamarckia cadamba is not limited to its biology only; it has a variety of other applications in ayurvedic treatment that have been listed in several Indian medical literary and mythological books. The phytochemistrical study of "cadamba plant" provides us with various curing techniques for numerous diseases such as diarrhoea, temperature, inflammation, haemoptysis, coughing, vomit, sores, ulcers, debility, antimicrobials, etc. The "cadamba plant" contains triterpenes, triterpenoid glycosides, flavanoids, saponins, indole alkaloids; cadambine, cadamine, isocadambine, isodihydrocadambineas as its major constituents (Table 3). Through investigation of the pharmacological activities of "cadamba plant," it is determined that it has various immunomodulatory, anti-microbial, anti-diabetic, anti-oxidant and other medicinal

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properties, which can help develop various preventative therapies and disease-curing strategies. With the same objective, the author has provided a comprehensive survey of various investigation works reported on chemical constituents and pharmacological actions of the "cadamba plant" in the current work. So that the medical professionals working in this area can refer to the present study for an apparent onset of the importance of medical values discovered in the cadamba plant before starting their investigation or experimentation.

III. CONCLUSION

Neolamarckia cadamba tree has long been used as an ayurvedic cure in several Indian traditional remedies and various medical formulations, including antibacterial ointments and herbal syrups. Even though profound research investigations have been conducted on Neolamarckia cadamba, or "kadam", for its use in disease treatments, a wise understanding of the physiological, ecological, phytochemical, and pharmacological behaviour of "kadam" has to be addressed. With this objective, current review paper presents a comprehensive survey of various studies has been reported on physiological, ecological, phytochemical and pharmacological behaviour.It further highlights the limits in information regarding cadamba's pharmacological properties, together with safety, and accuracy. The active ingredients aren't adequately defined, and there's little informa-
tion on toxicity or negative health impacts. In-depth research is needed on the toxicological analyses and its properties of pharmacological as well on biologically active extracts. Furthermore, there is insufficient data available on the production of food products from cadamba through report work.In addition to this, the extraction and evaluation of the active constituents of the cadamba plant appear to be valuable in determining the chemical structure and technique of action of the bio-active substances at the cellular scale, as well as assessing their usefulness in foods and medications for medical benefits. Although some of the pharmacological activities of cadamba have indeed been studied in animal studies, more in-depth research and understanding of their modes of action is required. It is also advised that attempts be made to extract, isolate, and collect
the reported as well as undiscovered chemicals from N. cadamba, in order to improve its pharmacologic characteristics and establish it as a contender for potential drug development.

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