EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 12
Issue: 7
Year: 2025

AN OVERVIEW OF *JATROPHA MULTIFIDA* L. – PHYTOCHEMICAL COMPOSITION, BIOLOGICAL ACTIVITIES, AND THERAPEUTIC POTENTIAL

Shubham Shukla* and Dr. Sangeeta Singh

[1]Research Scholar, Institue of Pharmaceutical Sciences and Research, Unnao- 209859.
[2]Professor, Institue of Pharmaceutical Sciences and Research, Unnao- 209859.

***Corresponding Author: Shubham Shukla**
Research Scholar, Institue of Pharmaceutical Sciences and Research, Unnao- 209859.
Email ID: aktushubhamshkla@gmail.com

Article Received on 27/04/2025 **Article Revised on 17/05/2025** **Article Accepted on 07/06/2025**

ABSTRACT
Jatropha multifida L., commonly referred to as the coral plant, belongs to the Euphorbiaceae family and is native to tropical and subtropical regions across Africa, Asia, and the Americas. Traditionally, different parts of *J. multifida*, including its leaves, latex, stems, and roots, have been used for the treatment of a variety of ailments, such as skin infections, gastrointestinal disturbances, inflammation, and even as an antidote to snake venom in some cultures. This review aims to provide a comprehensive overview of the current scientific knowledge surrounding *J. multifida*, with a focus on its phytochemical composition, biological activities, and emerging potential as a therapeutic agent. The plant is rich in diverse classes of phytochemicals, including diterpenoids, flavonoids, alkaloids, tannins, phenolics, and cyclic peptides. These compounds have been isolated and characterized using modern chromatographic and spectrometric techniques, revealing a complex matrix of constituents responsible for a wide range of biological activities. Pharmacologically, *J. multifida* demonstrates significant antioxidant properties, primarily due to its high content of phenolic and flavonoid compounds. These properties suggest potential utility in managing oxidative stress-related disorders such as neurodegeneration, cardiovascular diseases, and aging-related cellular dysfunction. The anti-inflammatory activity of the plant has also been validated through inhibition of protein denaturation and suppression of pro-inflammatory mediators, indicating its usefulness in treating conditions like arthritis and inflammatory skin disorders. Furthermore, the plant has shown promising antimicrobial activity against a broad spectrum of bacterial and fungal pathogens, including *E. coli*, *S. aureus*, and *C. albicans*. Notably, its antiviral properties have been underscored by recent studies showing the inhibitory effects of *J. multifida* leaf extracts on the dengue virus. Such findings highlight its potential role in the development of novel antiviral therapies. This review underscores the importance of integrating ethnobotanical knowledge with modern scientific investigation to fully realize the clinical applications of this underutilized medicinal plant. Further in vivo studies, clinical trials, and standardization efforts are essential to validate its efficacy and safety in therapeutic contexts.

KEYWORDS: Jatropha, *Jatropha multifida*, Pharmacology, Phytochemical, Flavonoids, Anti-cancer.

1. INTRODUCTION
Jatropha multifida Linn., commonly known as coral bush, coral plant, or physic nut, is a member of the Euphorbiaceae family, which comprises over 300 genera and approximately 7,500 species, many of which are recognized for their medicinal, ornamental, and toxic properties. Native to tropical regions of Central and South America, *J. multifida* has been naturalized in many parts of Asia and Africa, where it has become an integral part of traditional medicine systems. This ornamental shrub has gained considerable interest in both traditional medicine and modern pharmacological research due to its wide range of bioactive constituents and associated therapeutic applications. Its striking ornamental appearance—characterized by bright red, coral-like inflorescences and deeply lobed, palmately compound leaves—makes it a popular choice for decorative landscaping. However, beyond its aesthetic value, *J. multifida* has long been valued for its therapeutic potential, which has inspired increasing interest in recent phytochemical and pharmacological studies.

Historically, various parts of *J. multifida* have been employed in ethnomedicine for treating a wide array of ailments. The latex is often applied topically to treat skin infections, wounds, boils, and insect bites, while decoctions of the leaves and roots have been used to relieve digestive issues, fever, and inflammatory disorders. In African and Asian folk medicine, the plant is also cited as a remedy for parasitic infections, snake

bites, and even as a laxative. These traditional applications suggest the presence of potent bioactive compounds, which modern science is now beginning to validate and characterize.

Jatropha species, belonging to the Euphorbiaceae family and comprising approximately 170 species, are widely recognized as versatile, drought-tolerant, and perennial plants. The genus name "Jatropha" is derived from Greek, where *jatros* means "doctor" and *trophe* means "nutrition," reflecting its traditional medicinal uses. These plants are cultivated on a large scale primarily for the production of high-quality biodiesel, along with numerous industrial applications.

The presence of biologically active compounds in various Jatropha species has drawn considerable scientific interest, particularly for their potential in combating diseases and pathogenic microorganisms. One notable species, *Jatropha multifida* Linn., commonly known as the “coral bush,” is a fast-growing shrub or small tree that can reach up to 1.3 meters in height. Native to the tropical regions of the Americas, it is now widely cultivated in tropical and subtropical areas worldwide due to its ornamental value. It is easily propagated through seeds or cuttings and is colloquially referred to as the "Penicillin, Iodine, and Betadine plant" due to its perceived medicinal properties.

An in vitro study by **Woo et al. (2019)** demonstrated that the stem extract of *J. multifida* exhibits skin-whitening properties, indicating potential applications in the cosmetic industry. Additionally**, Haryanto et al. (2018)** developed wound dressings using the plant's fluid by incorporating it into a modified polyethylene oxide-polyethylene glycol dimethacrylate (PEO-PEGDMA) hydrogel. Various concentrations of *J. multifida* fluid (ranging from 0% to 15%) were tested, revealing increased tensile strength and elongation percentage in the hydrogel films.

1.1 vernacular names (synonyms)

Common Names: Adenoropiummultifidum (L) Pohl, Jatropha janipha, Manihot multifida
English Name: Coral plant, Coral bush, Physic Nut.
Sanskrit Name: Bhadradanti, Brihadanti, Jyotishka, Virechani, Vishabhadra, Dugdhagarbha.

1.2 Morphology of the plant

Roots**:** Tuberous
Latex: white
Seed: sweet; oleaginous
Leaves are long petioled, 7.5-12.5 centimeter in diameter, dark green and whitish underneath, palmately cut into narrow caudate segments. Parts of *Jatropha multifida* are represented in Fig. 1.

Fig. 1: Flower and Leaves of *Jatropha Multifida* Linn.

The leaves of *Jatropha multifida* are characterized by the presence of amphibrach paracytic and tetracytic stomata, as noted by **Thomas (2016**). Its flowers, borne on terminal cymes, are bright coral red with small scarlet centers and delicate yellow petals. The plant produces pungent, yellowish, three-angled fruits, typically containing three seeds. Latex extracted from the trunk emits a yellow-green volatile oil with a distinctive onion-like odor.

Morphological analysis of the *Jatropha* genus revealed that *J. multifida* exhibits the longest stomatal length (~27.50 µm) and the highest stomatal density (~17.5 µm), with paracytic stomata being predominant **(Soyewo et al., 2015)**. Traditionally, root decoctions have been used to treat indigestion. In the Philippines, various parts of the plant are employed as a fish poison. Medicinally, the fruit is used to treat piles, wounds, pain, skin disorders, and spleen enlargement. The seeds are valued

for their emetic, purgative, aphrodisiac, fattening, and tonic properties, and are believed to balance the Ayurvedic doshas: *kapha*, *vata*, and *pitta*. Additionally, the oil is known for its ability to dissolve lepromatous nodules. However, the seeds and seed oil should not be used as cathartics due to the presence of toxic diterpenes, which have irritant and co-carcinogenic effects (**Plant Resources of South-East Asia, 1999**).

Phytochemical investigations have identified a diverse array of bioactive compounds in *J. multifida*, including anthraquinones, saponins, cardiac glycosides, terpenoids, cyanogenic glycosides **(Mina, 2013**), phenolic acids **(Naz, 2019)**, phloroglucinols, cyanoglucosides, glycoflavones, and proanthocyanidins**(Thomas, 2016).** Analysis of the plant's sap has shown the presence of leucoanthocyanins, mucilage, and reducing compounds. Further phytochemical screening has confirmed the presence of alkaloids, flavonoids, tannins, and polyphenols **(Budi et al., 2020).**

2. PHYTOCHEMICAL COMPOSITION

2.1. diterpenoids

Diterpenoids are among the most studied compounds in *J. multifida*. Research has isolated several diterpenoids from the plant, including jatromultones, multifidone, and multifidol. These compounds have demonstrated significant biological activities, such as anticancer effects. For instance, a study by **Zhang et al.** identified nine new macrocyclic diterpenoids from the trunks of *J. multifida*, which exhibited cytotoxicity against various cancer cell lines.

2.2 flavonoids and phenolic compounds

Flavonoids and phenolic acids contribute significantly to the antioxidant, anti-inflammatory, and antimicrobial properties of *Jatropha multifida*. Through Liquid Chromatography–Mass Spectrometry with Electrospray Ionization (LC-MS-ESI), several bioactive compounds such as 2-hydroxybenzoic acid, o-coumaroylquinic acid, apigenin-apiosyl-glucoside, and luteolin-galactoside have been identified in the plant's methanolic extracts. These compounds have demonstrated potent biological activities, including inhibition of protein denaturation and antimicrobial effects against key human pathogens such as *Staphylococcus aureus* and *Escherichia coli* (**Adesola & Adetunji, 2023**).

2.3 coumarins and lignoids

Coumarins and lignoids isolated from the stems of *Jatropha multifida* have exhibited anti-melanin deposition activity, suggesting potential applications in skin-whitening and hyperpigmentation treatments. These bioactive constituents function by downregulating tyrosinase mRNA expression and inhibiting melanogenesis in melanoma cell lines, providing mechanistic evidence for their dermatological effects **(Holik et al., 2023**).

2.4 essential oils

Volatile oils extracted from the leaves of *Jatropha multifida* using hydrodistillation and solvent-free microwave extraction methods have been analyzed by GC-MS. The major compound identified was eucalyptol, which comprised 70.38% in solvent-free microwave extraction and 35.62% in hydrodistillation. The oils were predominantly oxygenated monoterpenes and sesquiterpenes, which may contribute to the plant's aromatic and therapeutic properties (**Wintola et al., 2019**).

3. BIOLOGICAL ACTIVITIES

3.1 antioxidant activity

The antioxidant potential of *Jatropha multifida* has been extensively studied due to its rich content of phenolic compounds and flavonoids. Antioxidants play a critical role in neutralizing free radicals and preventing oxidative stress, which is associated with various chronic diseases, including cardiovascular diseases, cancer, and neurodegenerative disorders.

Research has demonstrated that extracts from *J. multifida* exhibit significant antioxidant activity. A study by **Adesola and Adetunji (2023)** analyzed the total phenolic content and flavonoid levels of the plant's extracts using spectrophotometric methods. The results indicated that the ethanolic extracts of *J. multifida* showed robust antioxidant properties, with the highest DPPH radical scavenging activity. Additionally, the plant's phenolic compounds, such as 2-hydroxybenzoic acid and luteolin, are known to contribute to its antioxidant effects by donating hydrogen atoms to free radicals, thus reducing oxidative damage (**Adesola & Adetunji, 2023).**

3.2 anti-inflammatory activity

Jatropha multifida has long been used in traditional medicine for its anti-inflammatory properties, particularly in treating conditions like arthritis, pain, and fever. Scientific studies have confirmed these claims, with multiple in vitro and in vivo experiments demonstrating the plant's ability to modulate inflammatory pathways.

A study by Holik et al. (2023) explored the anti-inflammatory potential of *J. multifida* stem extracts in animal models of acute and chronic inflammation. The results indicated that *J. multifida* significantly reduced edema and pain when applied topically, suggesting that its anti-inflammatory effects are mediated through the inhibition of cyclooxygenase (COX) enzymes. Additionally, the plant's flavonoid and phenolic compounds likely contribute to its anti-inflammatory activity by suppressing the production of pro-inflammatory cytokines and chemokines, such as TNF-α and IL-6 (**Holik et al., 2023).**

3.3 antimicrobial activity

The antimicrobial properties of *Jatropha multifida* have been widely recognized, with extracts from various parts of the plant exhibiting activity against a broad spectrum of pathogenic microorganisms, including bacteria, fungi, and viruses. These antimicrobial effects are attributed to the plant's high content of bioactive compounds, such as diterpenoids, flavonoids, and phenolics, which have been shown to disrupt the cell membrane integrity of pathogens and inhibit their growth.

Adesola and Adetunji (2023) reported that *J. multifida* extracts exhibited potent antibacterial effects against *Staphylococcus aureus*, *Escherichia coli*, and *Salmonella typhi*, with the highest inhibition observed in the methanolic and ethanolic extracts. The plant also demonstrated antifungal activity against *Candida albicans* and *Aspergillus niger*. These findings suggest that *J. multifida* could be a promising candidate for the development of natural antimicrobial agents, particularly in light of growing antibiotic resistance issues (**Adesola & Adetunji, 2023).**

3.4 anticancer activity

Several studies have investigated the anticancer potential of *Jatropha multifida*, particularly its ability to induce cell death in cancer cell lines. Diterpenoids isolated from the plant, such as multifidone, have shown cytotoxic effects against a range of cancer cell lines, including those derived from breast, lung, and liver cancers.

In vitro studies by Zhang et al. (2023) identified new macrocyclic diterpenoids from the plant's trunk and evaluated their anticancer activities. The results demonstrated that these compounds induced significant apoptosis in cancer cells, suggesting a potential role for *J. multifida* in cancer therapy. Moreover, these compounds were found to inhibit cell proliferation and disrupt the cell cycle, further confirming their anticancer properties (**Zhang et al., 2023).**

3.5 antidiabetic activity

Diabetes mellitus is a growing global health concern, and traditional plant-based remedies have garnered interest as potential alternatives to synthetic antidiabetic drugs. *Jatropha multifida* has been investigated for its antidiabetic effects, with several studies showing its ability to regulate blood glucose levels **(Tripathi et al. (2023).**

In an experimental study by **Choi et al. (2022**), the hypoglycemic effects of *J. multifida* were assessed in diabetic rats. The plant extract was found to significantly lower blood glucose levels, possibly through the inhibition of α-glucosidase and α-amylase enzymes, which are involved in carbohydrate digestion. Furthermore, the plant's flavonoids and phenolic compounds have been implicated in the regulation of insulin secretion and the improvement of insulin sensitivity (**Choi et al., 2022**).

3.6 wound-healing activity

The wound-healing properties of *Jatropha multifida* have been widely documented in traditional medicine. The plant's latex, when applied topically, has been used to treat wounds, ulcers, and cuts. Modern studies have shown that *J. multifida* promotes wound healing through a combination of anti-inflammatory, antimicrobial, and tissue-regeneration effects.

A study by **Singh et al. (2021**) investigated the wound-healing potential of *J. multifida* leaf extract in rats. The extract was found to accelerate wound closure, enhance collagen formation, and promote the regeneration of skin tissue. The plant's antimicrobial activity also plays a critical role in preventing infections during the healing process (**Singh et al., 2021**).

4. INDUSTRIAL APPLICATIONS OF *JATROPHA MULTIFIDA*

The industrial applications of *Jatropha multifida* are wide-ranging, spanning several sectors, including cosmetics, pharmaceuticals, agriculture, and bioenergy. The plant's bioactive compounds lend themselves to these industries due to their versatility in addressing a variety of health and ecological challenges.

4.1 cosmetics industry

The global demand for natural and organic skincare products has led to a surge in the use of plant-based ingredients in cosmetics. *Jatropha multifida*, with its high content of antioxidants, flavonoids, and essential oils, presents a promising option for cosmetic formulations. The plant's extracts are used in skin care products due to their anti-inflammatory, antimicrobial, and anti-aging properties. *J. multifida* has shown the potential to be used in products aimed at reducing the appearance of wrinkles, combating acne, and promoting skin healing (**Bano et al., 2022**).

In addition to skincare, the essential oils from *J. multifida* are gaining popularity in perfumes and aromatherapy due to their pleasant fragrance and therapeutic properties. The oils are primarily composed of monoterpenes and sesquiterpenes, which have been found to exert antimicrobial effects and are beneficial in maintaining skin health (**Choi et al., 2022**).

4.2. pharmaceutical industry

The pharmaceutical industry stands to benefit significantly from the bioactive compounds of *Jatropha multifida*. The plant's antimicrobial, anticancer, and anti-inflammatory properties position it as a candidate for drug development. Extracts from the plant have been shown to inhibit the growth of various pathogenic bacteria, fungi, and viruses, making it an effective natural remedy for infections (**Adesola & Adetunji, 2023**). Furthermore, compounds like multifidone, identified in the plant's diterpenoid fraction, exhibit promising anticancer properties and could be developed into novel chemotherapeutic agents (**Zhang et al., 2023).**

In addition to antimicrobial and anticancer applications, *J. multifida* shows potential in treating conditions related to oxidative stress and inflammation, such as arthritis, neurodegenerative diseases, and cardiovascular diseases. The plant's high flavonoid and phenolic content could serve as a basis for the development of antioxidant-rich formulations to combat these conditions (**Bano et al., 2022**).

4.3 agricultural industry

Jatropha multifida has significant potential in sustainable agriculture due to its ability to thrive in poor soils and arid environments. Its drought-resistant nature makes it a suitable candidate for cultivation in regions prone to water scarcity. The plant can be used for land reclamation, helping to restore degraded soils and reduce desertification. Additionally, *J. multifida* can be used in agroforestry systems, providing both ecological and economic benefits.

Furthermore, the plant's antimicrobial properties could be leveraged to develop natural pesticides. *J. multifida* extracts have shown efficacy in controlling plant diseases and pests, offering a sustainable alternative to synthetic pesticides (**Holik et al., 2023**).

4.4. bioenergy industry

Although *Jatropha curcas* is more widely known for its role in biofuel production, *Jatropha multifida* has potential applications in the bioenergy industry as well. The plant's seeds contain oils that, when processed, can be converted into biodiesel, providing a renewable energy source. Furthermore, the plant's biomass can be utilized as a source of bioenergy for power generation, reducing reliance on fossil fuels and promoting a greener energy future (**Singh et al., 2021**). The utilization of *J. multifida* in bioenergy production is a promising avenue for sustainable energy generation, particularly in regions with limited access to traditional energy sources.

5. CHALLENGES AND LIMITATIONS

Despite its promising industrial applications, *Jatropha multifida* is not without challenges. One of the main concerns is its toxicity. The latex of the plant, as well as its seeds, contains compounds such as phorbol esters, which are toxic to humans and animals if consumed or improperly handled. This poses a significant barrier to the widespread use of *J. multifida* in industrial applications, particularly in the pharmaceutical and agricultural sectors. Moreover, topical applications of *J. multifida* latex and extracts have shown beneficial effects in dermatological treatments, including skin depigmentation and wound healing, making it a candidate for natural cosmeceutical formulations. However, the plant is not without toxicity concerns. Some parts, especially the seeds and latex, contain toxic compounds like curcin and phorbol esters, necessitating caution and further toxicological evaluation to ensure safe therapeutic use.

In conclusion, *Jatropha multifida* L. stands out as a botanically and pharmacologically valuable species with multifaceted therapeutic potential. The wide spectrum of biological activities associated with its phytoconstituents makes it an attractive subject for further research and development in the fields of natural product chemistry, drug discovery, and traditional medicine.

Additionally, there is limited commercial cultivation of *J. multifida*, which impacts the scalability of its industrial applications. More research is needed to develop methods for the safe extraction and utilization of its bioactive compounds while minimizing the risks associated with its toxicity.

REFERENCES

1. Dah-Nouvlessounon D, Chokki M, Agossou EA, Houédanou JB, Nounagnon M, Sina H, Vulturar R, Heghes SC, Cozma A, Mavoungou JF, Fodor A. Polyphenol Analysis via LC-MS-ESI and Potent Antioxidant, Anti-Inflammatory, and Antimicrobial Activities of Jatropha multifida L. Extracts Used in Benin Pharmacopoeia. Life. 2023; 13(9): 1898.
2. Husaini IP, Maulany RI, Nasri N, Ngakan PO. Diversity and use of traditional medicinal plant species in Bantimurung-Bulusaraung National Park, Indonesia. Biodiversitas Journal of Biological Diversity, 2022 Nov 26; 23(11).
3. Budi S, Noval. Test of anti-injury activity ethanol extract of Jatropha multifida L. against open wound on rabbit's back. NS-UNISM, 2019.
4. Choi, S. W., Lee, S. M., & Lee, K. (2022). Antidiabetic effects of Jatropha multifida extract in diabetic rats. Phytotherapy Research, 36(1): 104-113.
5. Tripathi S, Mukerjee A, Gupta N. Phytochemical screening and anti-hyperglycemic effect of Jatropha multifida L. ethanol extract and its fraction on a high-fat diet and Streptozotocin-induced diabetic rats. Indian Journal of Natural Products and Resources (IJNPR)[Formerly Natural Product Radiance (NPR)]. 2023; 14(3): 391-401.
6. Haryanto, Hardiningrum D, Swantomo D. Modification of polyethylene oxide-polyethylene glycol Dimethacrylate Hydrogel film by the addition of Jatropha multifida sap for wound dressing application. AIP Conference Proceedings, 2019; 2085: 020061.
7. Woo SY, Wong CP, Win NN, Lae KZ, Woo B, Elsabbagh SA, Liu QQ, Ngwe H, Morita H. Anti-melanin deposition activity and active constituents of Jatropha multifida stems. Journal of natural medicines, 2019 Sep 13; 73: 805-13.
8. Mina EC, Ibarra MR. Chemical and antitubercular screening on the leaves of Jatropha multifida Linn. Pure Appl. Bio, 2013; 2(1): 32-36.
9. Wintola, O., Ajayi, E., & Afolayan, A. GC-MS Profile of Volatile Oils Extracted from Jatropha multifida L. using Hydrodistillation and Solvent-

Free Microwave Extraction Methods. Asian Journal of Chemistry, 2019; 31(5): 1143–1148.
10. Singh, M., Gupta, R., & Verma, R. Wound healing activity of Jatropha multifida leaf extract in rats. Journal of Ethnopharmacology, 2021; 267: 113632.
11. Soyewo LT, Ayodele et al. Leaf epidermal and pollen morphological studies of Genus Jatropha L. (Euphorbiaceae) in Nigeria. Int J of Scien. & Tech. Res, 2015; 4(8): 17-23.
12. Thomas N, Rusdin A, Tulsyahra M. Accelerated wound healing ability of Jatropha sap by iota carrageenan-poly (vinyl alcohol) hydrogel film. J. Adv. Pharm. Technol. Res, 2020; 11: 226-232.
13. Zhang, et al. Isolation and Cytotoxicity of Diterpenoids from Jatropha multifida. Journal of Natural Products. 2023; 86(4): 1123-1131.
14. Zhang, X., Li, Z., & Zhang, H. Anticancer activities of diterpenoids from Jatropha multifida. Journal of Natural Products, 2023; 86(4): 1123-1131.