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Ziziphus Nummularia: A Resilient Medicinal Shrub of Great Pharmacological Potential

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Abstract

The shrub of Ziziphus nummularia (Burm.f.) from family Rhamnaceae has been a subject of scientific interest for its ancient medicinal practices. To this date, it has a high ethnobotanical value throughout South Asia for treating a range of diseases. However, scientific exploration of its pharmacological and phytochemical properties remains limited. This review article is an attempt to combine existing published information on Ziziphus nummularia's Botany, Ecology, Ethnobotany and Ethnopharmacology and highlights the rich phytochemistry of constituents such as flavonoids, alkaloids, saponins, tannins and triterpenoids. Ziziphus nummularia was found to have broad pharmacological activities such as antimicrobial, antioxidant, antidiabetic, anti-inflammatory, anticancer, and wound healing effects, although mostly with preclinical studies. The morphological and genetic diversity across various regions of Pakistan prove the eco farming and conservation possibilities for the species. The remaining gaps in knowledge seem to be lack of bioactive compound identification, mechanisms of actions, and clinical trials for efficacy validation. Multidisciplinary approaches focusing on ethnopharmacology, molecular biology, biochemistry, and medicine could fully utilize the potential of Ziziphus nummularia.

Keywords: Genetic diversity, Pharmacological activities, Phytochemicals, Therapeutic potential, *Ziziphus nummularia*.

INTRODUCTION

The plants held important value in folk medicine which acclaimed them for their beneficial properties for numerous health disorders, while even in modern medicine, they continue to hold relevance (Tripathi et al., 2019). In analyzing the contemporary era, it can be noted that a growing global population alongside limited access to pharmaceuticals, as well as the side effects of synthetic drugs have sparked interest in plant-based remedies from the scientific and commercial fields (Muhammad et al., 2022). Although there are about 250,000 species of plants in the world, only 10% are studied for their therapeutic importance. These plants include bioactive nutrients like phytochemicals, secondary metabolites, as such serve useful for the development of drugs (Odieka et al., 2022; Yeshi et al., 2022). Phytotherapy is the technique that utilizes these bioactive compounds and is currently estimated to account for a quarter of all medicine produced. Besides, plants are appreciated for their low toxicity and ability

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to endure environmental stress, making them valuable specimens for clinical research (Najmi et al., 2022). *Ziziphus nummularia* (Burm.f.) is a wild and resilient planted species that grow in the Indian subcontinent, along with Pakistan and India, and has persistent uses in the region's traditional medicine, categorizing the species under the Rhamnaceae family. Common in Pakistan, it is found in Balochistan, Khyber Pakhtunkhwa, Punjab, and other arid regions. Usually reaching 6–8 feet, *Ziziphu nummularia* is a spiny, small bush. It is known locally as Karkanr or Jharberi; it grows in dry and semi-arid regions. It is frequently contrasted with its relative, *Ziziphus jujuba* (Chinese date), a taller tree/shrub reaching 20–30 feet in height. Unlike the more visible scented blossoms and oval leaves of *Z. jujuba*, *Ziziphus nummularia* blooms tiny yellowish-green flowers and is well suited to drought, so it is helpful in reforestation and soil remediation. Pakistan's arid and desert regions provide great opportunities for *Ziziphus nummularia* growth. In Pakistan the areas like Gwadar, Buner, Dir Lower, and Swat show notable genetic and physical variety within this species. Variations in spine length, tomentosity, leaf borders, and stem and fruit color have been observed in research studies. Using slab gel electrophoresis, seed protein analysis showed 12 polymorphic bands; Unweighted Pair-Group Method with Arithmetic mean (UPGMA) and Principal component analysis (PCA) methods confirmed regional clustering. The common vernacular names of *Ziziphus nummularia* include in Pashto: Karkanrh, in Punjabi: Beri, in Sindhi: Jangri, in Hindi/Sanskrit: Ber / Rajabadari, in Gujarati: Bordi, in Chinese: Da Zao, Hong Zao, and in Botanical: *Ziziphus jujuba*. Economically, the Ziziphus genus is important in Pakistan, with ~5,425 acres of jujube orchards yielding ~28,000 tonnes of fruit annually (Uddin et al., 2021). These fruits are eaten fresh or dried and are rich in nutrients, including proteins, carbohydrates, vitamins, minerals, organic acids, and bioactive compounds such flavonoids, saponins, terpenoids, and alkaloids (Aafi et al., 2022).

The aim of the present review was to comprehensively explore the therapeutic potential and phytochemical profile of *Ziziphus nummularia* based on current scientific literature. It highlights: Traditional uses, Pharmacological activities, Genetic diversity, and Potential for drug development

METHODOLOGY

A comprehensive literature review was performed using Google Scholar, Scopus, PubMed, and Web of Science. Keywords used included: *Ziziphus nummularia* + phytochemistry, *Ziziphus nummularia* + pharmacology, *Ziziphus nummularia* + antimicrobial, etc. Out of 245 articles, 99 were selected based on relevance and specificity.

Traditional and Ethnobotanical Uses

Historically, various parts of *Ziziphus nummularia* have been used in indigenous medicine: Leaves are used in poultices for skin infections and ulcers. Fruits are consumed to treat digestive issues. Roots/Bark are prepared as decoctions to treat fever, cough, and gastrointestinal problems. These uses have been confirmed by ethnobotanical studies across Pakistan and other parts of South Asia (Marwat et al., 2009).

Phytochemical Profile

Ziziphus nummularia contains a broad range of secondary metabolites, including flavonoids (quercetin, rutin), alkaloids, saponins, tannins, glycosides, and triterpenoids. These compounds are known for their pharmacological effects and therapeutic potential (Sing B et al., 1995).

Pharmacological Activities

Research (in vitro as well as in vivo) has confirmed numerous biological activities antimicrobial, antioxidant, analgesic/anti-inflammatory, antipyretic, hepatoprotective, antidiabetic, anticancer, wound healing, and the detailed pharmacological insights are mentioned in table 1. Based on the above biological activities, this plant is becoming a strong candidate for its clinical authentication in human populations (Spagnol et al., 2019; Alam et al., 2022; Pavlíková, 2022).

Table 1. Pharmacological Activities of *Ziziphus nummularia*

S.No.	Activity	Details	References
1	Anthelmintic Activity	Ethanolic extracts effective against Haemonchus contortus and GI nematodes in vitro and in vivo (sheep models).	Bachaya et al., 2009
2	Antibacterial Activity	Aqueous and ethanolic extracts inhibited Bacillus cereus and other bacteria due to rich bioactive compounds.	De Boer et al., 2005
3	Antifertility and Abortifacient Activity	Root bark with candy sugar and milk showed contraceptive and abortifacient properties.	Shah et al., 2006
4	Antioxidant Activity	Extracts rich in phenolics and polysaccharides displayed strong antioxidant activity.	Kar et al., 2013; Ji et al., 2022
5	Antimicrobial Activity	Flavonoids and phytochemicals effective against E. coli, S. aureus, Klebsiella, Salmonella.	Beg et al., 2016; Alhassan et al., 2019
6	Antitumor Activity	Compounds like lapachol showed cytotoxicity on breast and colon cancer cell lines.	Kumar et al., 2002; Periasamy et al., 2015
7	Anti-asthmatic & Anti-allergic Activity	Jujube extracts reduced asthma and allergy symptoms via mast cell stabilization and anti-inflammatory effects.	Ninave et al., 2019; Naik et al., 2013
8	Antidiabetic Activity	Triterpenoids improved insulin sensitivity and glucose uptake; human studies showed glycemic and lipid control.	Jamshidi et al., 2014; Yazdanpanah et al., 2017
9	Hepatoprotective & Gut Health Benefits	Protected liver and improved gut health by regulating ammonia levels and promoting probiotics.	Liu et al., 2012; Wang et al., 2015
10	Anti-influenza Activity	Betulinic acid exhibited antiviral action against influenza virus with low toxicity.	Hong et al., 2015
11	Antihypertensive Activity	Hydroalcoholic extracts reduced L-NAME-induced hypertension by increasing nitric oxide availability.	Mohebbati et al., 2018
12	Nephroprotective Activity	Aqueous fruit extract reduced ibuprofen-induced nephrotoxicity and oxidative stress.	Awad et al., 2014
13	Antimelanogenic Activity	Jujube syrup reduced facial hyperpigmentation and pigment density in clinical studies.	Aafi et al., 2022
14	Anti-inflammatory Activity	Alleviated acute and chronic inflammation via flavonoids, terpenes, saponins, and NO inhibition.	Goyal et al., 2011
15	Anti-aging Activity	Extended lifespan and improved strength in Drosophila models, indicating anti-aging potential.	Ghimire et al., 2017
16	Anti-genotoxic Activity	Polyphenol-rich extracts protected DNA from oxidative damage and enhanced endogenous antioxidant enzyme activity.	Goswami et al., 2019

Genetic and Ecological Considerations

ASRic studies reveal considerable variation among *Ziziphus nummularia* populations. This diversity offers opportunities for domestication and ecological applications like soil reclamation, dryland farming, and agroforestry (Padari et al., 20016).

CONCLUSION

Ziziphus nummularia possesses a rich phytochemical composition and a wide range of pharmacological effects, making it a promising candidate for modern drug development. Its antioxidant, anticancer, hepatoprotective, and anti-inflammatory properties underscore its potential in treating various health conditions. Further exploration of its bioactive compounds, along with clinical validation, could support the development of novel therapeutics rooted in traditional knowledge.

Future Recommendations

Further research is essential to:

- Isolate and characterize key phytochemicals
- Understand molecular mechanisms of action
- Conduct toxicity and dose-response studies
- Validate findings through clinical trials
- Promote sustainable harvesting and conservation

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