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Unveiling the phytochemical profile of *Crassula ovata:* A review on its Medicinal potential.

Komal Hangloo[1], Ms. Neelam Painuly[2],B Vishnu Vardhan[3],Anupam Thakur[4],Shivam Chandra[5]
[1,3,4,5]Research Scholar, School of Pharmacy and Research, DBUU, Dehradun. India.; komalhangloo7136@gmail.com
[2]Associate Professor, School of Pharmacy and Research, DBUU, Dehradun. India.
neelu.painuly@gmail.com

Abstract*: Crassula ovata, a succulent plant that belongs to family Crassulaceae, has been traditionally used for its medicinal properties and is a promising medicinal plant with a rich history of traditional use and a diverse range of pharmacological activities. This review aims to provide a comprehensive overview of the phytochemical constituents and pharmacological actions of Crassula ovata. The plant has been reported to contain a diverse range of bioactive compounds, including flavonoids, phenols, alkaloids, Phytosterols and terpenoids. These compounds have been proven to exhibit anti-microbial, anti-oxidant and anti-diabetic activities. This review highlights its potential as a source of natural products for the prevention and treatment of various disease with a special focus on the morphology and the microscopical features of the jade plant. And it also highlights the need for further research on Crassula ovata to fully explore its therapeutic potential and to ensure its safe and effective use to unlock its full therapeutic potential and to provide evidence-based support for its traditional uses.*
Keywords*: Crassulaceae, Crassula ovata, jade plant, phytochemical, alkaloids*

INTRODUCTION

In past years many ethnic communities of north east India have been using plants as medicines from long years to treat illness. These plants are special because they have unique properties that make them useful for healing. Today, these medicinal plants are considered very important because they contain powerful phytochemicals that can be used to create new medicines. [1,3]

Crassula is a versatile plant and has about 195 recognised species including known *Crassula ovata* plant which is basically a crassulent species.[2] In most of the places it is commonly known as ornamental plant or jade plant. It belongs to family Crassulaceae. These plants are known for their adaptations to dry conditions, such as thick, fleshy leaves and stems that store water, making them perfect for low-maintenance gardening and xeriscaping. It has been cherished for centuries in traditional medicine, horticulture, and ornamental decoration. [2,3]

Belonging to the Crassulaceae family, this evergreen shrublet has adapted to thrive in arid environments, boasting striking, ovate leaves and a robust, tree-like growth habit. Native to South Africa, *Crassula ovata* has been naturalized in various parts of the world.[1]

Biological Description: [2]

Kingdom	Plantae
Phylum	Magnoliopsida
Class	Angiospermae
Order	Saxifragales
Family	Crassulaceae
Genus	*Crassula*
Species	*Ovata*

Table 1: Taxonomy of *Crassula ovata*

Figure 1: *Crassula ovata* plant

Ecology and Propagation

Crassula ovata, also known as Jade Plant, has adapted clever ways to thrive in dry conditions like Water-Saving Strategy which minimizes water loss through a specialised process of photosynthesis called crassulacean acid metabolism (CAM). During night time CO2 Collection with which Stomata (tiny pores)

close during the day and open at night, storing CO2 in the form of organic acids. At Daytime Photosynthesis occurs when these acids break down, releasing CO2 for photosynthesis, reducing water loss. Thus, survival mode is through CAM idling which in extreme drought, stomata remain closed, recycling CO2 internally, slowing growth but maintaining cell health.[3]

Drought-Tolerant Features: Succulent Leaves, Stems, and Roots: Store water for survival. Easy Propagation as roots grow from any stem part, even a single leaf. Also, Self-Regeneration takes place as fallen leaves near the base sprout new plants.[4]

Morphological description:

Figure 2: Leaves of *Crassula ovata*

Figure 3: *Crassula ovata* stem

The jade plant is a small tree or shrub that grows up to 1-1.5 meters tall.[20] It has thick sturdy branches. Its leaves are thick and fleshy and are vibrant green in colour. Also, the leaves are egg shaped or elliptical and are 3-9 cm long and 1.8-4 cm wide and often had pointed tip.[8] These leaves grow in pairs on the branches opposite to each other. The new stems are green and soft just like the leaves as they turn old, they became woody and turns brown. If conditions are favourable, it also produce small star shaped flowers in early springs which are either pink or white in colour. After flowering, tiny seeds pod form that containing many tiny seeds. [1,2]

Microscopical Description:

Using a powerful electron microscope, scientists sliced the plant into thin sections, revealing its intricate secrets. At ×10 magnification, the leaves appear thick and hard, with a unique fatty texture – hallmark characteristics of succulents. Delving deeper, the ×40 and ×100 objective lenses expose: - Chlorenchyma, the plant's food-producing tissue, blends seamlessly into surrounding cells, making it difficult to distinguish, Vascular bundles: responsible for transporting water and nutrients, are scattered throughout the leaf like a network of hidden pathways, Air cavities are scarce, while cells appear swollen, storing precious water for survival. These remarkable adaptations enable Crassula ovata to thrive in arid environments, making it a resilient and captivating specimen.[6]

ETHNOMEDICINAL USES:

1) Around 700 A.D., the jade plant was a common medicinal ingredient in Asian societies, especially in China. To cure the symptoms of diabetes, medical professionals recommended a tea prepared from the jade plant. The soft, plentiful jade plant was employed in bonsai art because it was easy to bend into different shapes.[18]
2) According to the traditional usage of several people in North East India, particularly in Manipur, Crassula ovata is primarily used to treat diabetes and certain infections. They used to treat diabetes by consuming the plant's leaf juice. However, not much research has been done to assess its effectiveness in a scientific manner. [1]

3) The fluid extract from Crassula ovata leaves has long been used by many societies to treat warts, which are tiny, firm, confined tumours of the epidermis that are brought on by different strains of the infectious human papillomavirus (HPV).[2]

PHYTOCHEMICAL CONSTITUENTS:

Crassula ovata:

S NO.	SOLVENT TYPE	PART OF THE PLANT	PHYTOCHEMICALS PRESENT
1.	Aqueous	Leaves	Alkaloids Flavonoids Carbohydrates Tannins Phytosterols Terpenoids
2.	Methanol	Leaves	Alkaloids phenolic Compounds tannins glycosides Phytosterols Flavonoids Terpenoids
3.	Ethanol	Leaves	Alkaloids phenolic Compounds tannins Carbohydrates glycosides Phytosterols Flavonoids Terpenoids
4.	Chloroform	Leaves	Alkaloids phenolic Compounds tannins glycosides Phytosterols
5.	Acetone	Leaves	Alkaloids phenolic Compounds tannins glycosides Phytosterols

Table 2: Phytochemicals present in leaves of *Crassula ovata* [3,7]

SNO.	SOLVENT TYPE	PLANT PART	PHYTOCHEMICAL PRESENT
1.	Aqueous	Stem and Root	Alkaloids Flavonoi ds Carbohydrat es Saponins Sterols
2.	Methanol	Stem and Root	Sterols Saponins Carbohydrat es

Table 3: Phytochemical present in stem and root of *Crassula ovata.* [5]

PHARMACOLOGICAL ACTIONS:

Antioxidant property:

ACTIVITY	METHOD USED	PART OF THE PLANT USED	PHYTOCHEMICAL RESPONSIBLE	SOLVENT USED	RESULTS
Anti-oxidant	DPPH and hydrogen peroxide scavenging methods	Leaves	Flavonoids and phenolic compounds [16]	Aqueous and Methanol	The aqueous extract showed good Anti-oxidant property

Table 4: Antioxidant activity reported on *Crassula ovata.*

Studies have shown that *Crassula ovata* plant exhibits antioxidant property.

The antioxidants present in jade plant helps in neutralising of some of the harmful radicals from the body. This activity can be due to hydrogen donating capability or electron donating capability. Thus, the phytochemicals present in crassula ovata such as carbohydrates and reducing sugar can be responsible for this antioxidant activity. This activity was evaluated using DPPH method and Hydrogen peroxide scavenging activity method.[9] In addition the solvent used for extract of leaves were aqueous and methanol.[10] The aqueous extract showed good antioxidant property.[9]

Anti-microbial Activity:

S no.	ACTIVITY	METHOD USED	PART OF THE PLANT USED	PHYTO CHEMIC AL RESPON SIBLE	SOLVENT AND MICROBES USED	RESULTS	REFERENCE
1.	Anti-Microbial	Sample extract and Disc preparation	Leaves	Flavonoid s, tannins, Saponins [17]	95% ethanol S. aureus, S. agalactiae, E. coli, K. pneumoniae, E. cloacae and P. Vulgaris	C.ovata has shown clear inhibition zone against both bacteria (gram positive and gram negative) hence could be effective in order to form antibiotics.	[11]
2.	Anti-Microbial	Agar disc diffusion method	Leaves	Flavonoid s [17]	Aqueous and Methanol E.coli, pseudomona, klebsilla sp.	The zone of inhibition was maximum in the aqueous extract. Also, in *Crassula ovata* water extract the E. coli was seen more sensitive.	[9]

Table 5: Anti-microbial activity reported on *Crassula ovata.*

This study looked at how well Crassula ovata (also known as jade plant) fights bacteria (gram positive and gram negative) and Samples of the plant's leaves were soaked in 95% ethanol, and the extract was used to treat paper discs. These discs were then placed on bacteria-filled plates to see if they could stop the growth of bacteria. The researchers measured the clear areas around the discs to determine how effective the extract was.

The results showed that C. ovata could inhibit the growth of several types of bacteria, including K. pneumoniae, E. cloacae, E. coli, P. vulgaris, S. agalactiae, and S. aureus. This means C. ovata has broad-spectrum antibacterial properties.[11]

This study was examined using the extract of Crassula ovata against three strains: E coli, pseudomonas, klebsilla species. The antibacterial test was conducted using the method Agar Disc Diffusion [12] on Mueller-Hinton agar, [13,14] following the procedures outlined by CLSI [15]. In this method, compounds having Anti-microbial property were placed on sterile filter paper discs, which then diffuse through agar. For the test, 1 mg/ml concentration of the extracts was used. Each test was repeated three times to ensure reliable results. After incubating the plates overnight, the researchers measured the zones of inhibition (the areas where bacterial growth was stopped) in millimeters using a ruler. The average inhibition zones for each bacterium were computed and expressed as mean ± standard deviation (SD) based on three replicate trials. Subsequent statistical analysis was performed utilizing Minitab 17's free version."

The result showed that the extract prepared in water showed maximum zone of inhibition. Hence the standard study showed that the strain that was found to be more sensitive to the extract of Crassula ovata leaves was E. coli.[9]

Anti-Diabetic activity:

ACTIVITY	METHOD USED	PART OF THE PLANT USED	SOLVENT AND ENZYME USED	RESULTS	REFERENCE
Anti-diabetic	Invitro activity to inhibit alpha amylase activity	Leaves	Aqueous and Methanol Alpha Amylase	Methanol shows higher inhibition rate of alpha amylase as compared to aqueous extract of alpha amylase.	[9]

Table 6: Anti-diabetic acitivity reported on *Crassula ovata.*

The study on *Crassula ovata* leaves indicated that the both aqueous and methanol extracts effectively inhibit alpha-amylase activity in vitro, with methanol extracts showing a higher inhibition rate (83.00% at 700 µg/ml) compared to aqueous extracts (73.80% at the same concentration). These results suggest potential antidiabetic properties, warranting further investigation into in vivo effects to validate traditional uses, particularly among Manipuri tribes that utilize the aqueous extract.

This test was done by preparing starch solution, enzyme solution of alpha amylase and colorimetric solution. The plant extract was thus added in the starch solution and left so that it can react under alkaline condition with alpha amylase. By the reduction of 3,5-dinitrosalicylic acid to 3-amino-5-nitrosalicylic acid the Maltose generation was determined. The absorbance was measured at 540 nm for the resulting solution [16,17] to quantify the maltose produced.

This method effectively assesses the inhibitory effects of the extracts by measuring the change in absorbance, which correlates with the amount of maltose generated, thus reflecting alpha-amylase activity.

CONCLUSION

For generations, traditional medicine has made use of the jade plant, or *Crassula ovata*. Flavonoids, phenolic acids, and terpenoids are among the plant's abundant phytochemical profile, which supports its wide range of pharmacological actions, including antidiabetic, antioxidant, and antibacterial properties. Traditional uses of *Crassula ovata* include the treatment of wounds, skin disorders, and respiratory infections. Recent studies have confirmed some of these traditional uses, pointing to possible uses in antimicrobial therapy and Anti-diabetic. However, more investigation is required to completely examine

Crassula ovata's therapeutic potential, including its safety, effectiveness, and interactions with other drugs. Standardized extraction and formulation techniques are also necessary to guarantee the constant quality and bioactivity of products derived from *Crassula ovata.*

In conclusion, *Crassula ovata* is a promising medicinal plant with a rich history of traditional use and a diverse range of pharmacological activities. Further research and development are necessary to unlock its full therapeutic potential and to provide evidence-based support for its traditional uses.

REFERENCES

1. Kalita, Partha & Chokhone, K. & Talukdar, Nayan & Sarma, Manash & Das, Karabi. (2017). Screening of phytochemicals and evaluation of anti-microbial, anti-oxidant and in-vitro antidiabetic activity of Crassula ovata leaves. International Journal of Pharmaceutical Sciences and Research. 8 (2017). 859-864. 10.13040/IJPSR.0975-8232.8(2).859-64
2. Putta, Dr. Swathi. (2024). FROM JADE TO HEALTH: A HOLISTIC REVIEW OF CRASSULA PHYTOCHEMISTRY AND PHARMACOLOGY. 11. 111.
3. Preliminary phytochemical screening of various extracts of jade (Crassula ovata) plant in India Crossref DOI link: https://doi.org/10.30574/wjbphs.2024.17.3.0106
4. Published Online: 2024-03-30
5. Denis, Mwangi & Wambura, Mwangi. (2016). Phytochemical and Antimicrobial Activity of (Crassula ovata) Jade Plant on Different Strains of Bacteria. European Journal of Medicinal Plants. 11. 1-12. 10.9734/EJMP/2016/19753.
6. Kumar S, Kumar V, Prakash OM. Microscopic evaluation and physiochemical analysis of Dillenia indica leaf. Asian Pac J Trop Biomed. 2011 Oct;1(5):337-40. doi: 10.1016/S2221-1691(11)60076-2. PMID: 23569789; PMCID: PMC3614203.
7. Praciak,Andrew, cabicompendium.113574, CABI Compendium, doi:10.1079/cabicompendium.113574, CABI International, Crassula ovata (jade plant), (2022)
8. Puga, Troy & Schafer, Joshua & Buffalo, Alexander & Agbedanu, Prince. (2022). Broad-spectrum antimicrobial potential of Crassula ovata. Journal of Medicinal Plants Studies. 10. 42-45. 10.22271/plants.2022.v10.i3a.1422.
9. EUCAST disk diffusion method for antimicrobial susceptibility testing Reading guide, Version 4.0, June 2014.
10. Sheeba, E. (2010). Antibacterial Activity of Solanum surattense Burm. F. *Kathmandu University Journal of Science, Engineering and Technology, 6*, 1-4.
11. Uddin N, Rahman A, Ahmed NU, Rana S, Akter R, Masudul AM, Chowdhury A. Antioxidant, cytotoxic and antimicrobial properties of Eclipta alba ethanol extract. Int J Biol Med Res 2010; 1(4): 341-346.)
12. CLSI: Methods for antimicrobial dilution and disk susceptibility testing of infrequently isolated or fastidious bacteria; approved guideline M45-A. Clinical and Laboratory Standards Institute, Wayne. 2005.
13. Mallick CP and Singh MB. Plant enzymology and Histoenzymology (eds), Kalyani publishers, New Delhi, 1980; 286. (antidiabetic)
14. Gupta R and Misra A. In vitro antidiabetic activity of pentacyclic tritrprnoida and fatty acid ester from bauhinia purpurea. British Journal of Diabetes and Vascular Disease; 2007; 7; 16-25. (antidiabetic)
15. Eggli, U. (Ed.). (2002). Illustrated handbook of succulent plants: dicotyledons. Springer Science & Business Media.
16. López-Angulo, G., Montes-Avila, J., Díaz-Camacho, S. P., Vega-Aviña, R., BáezFlores, M. E., & Delgado-Vargas, F. (2016). Bioactive components and antimutagenic and antioxidant activities of two Echeveria DC. species. Industrial Crops and Products, 85, 38-48.
17. Adesanoye OA, Farombi EO. In Vitro Antioxidant Properties of Methanolic Leaf Extract of Vernonia Amygdalina Del. Niger J Physiol Sci. 2014 Dec 29;29(2):91-101. PMID: 26196573.
18. Parekh, Jigna & Chanda, Sumitra. (2010). Antibacterial and phytochemical studies on twelve species of Indian medicinal Plants. African Journal of Biomedical Research (ISSN: 1119-5096) Vol 10 Num 2. 10. 10.4314/ajbr.v10i2.50624.