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(RESEARCH ARTICLE)

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Preliminary phytochemical screening of various extracts of jade (*Crassula ovata*) plant in India

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Abstract

Medicinal plant are chief antidote for numerous diseases and have been used since time immemorial. Many years have passed since the *Crassula ovata* plant was utilised as an ornamental and therapeutic herb in some communities, such as the Khoi in South Africa and Chinese culture. This manuscript covers a detailed pharmacognostic evaluation of *Crassula ovata*. Whole plant *Crassula ovata*, including morphology, microscopy, physicochemical, and phytochemical screening. Microscopy of different plant part was done by performing transverse sections, which were identified by the different staining reagents and dyes. The whole plant's physicochemical constants, which consist of moisture content, extractive value, and ash value, were determined. Phytochemicals screening was done for methanol, ethanol, chloroform, acetone and water extract of *Crassula ovata*. Phytochemical analysis from the extracts was performed using the standard methods. Phytochemical analysis of the extract indicated the present of Saponin, phenol, phytosterol, steroid, terpenoid, flavonoid, carbohydrates and proteins. The Pharmacognostic evaluation generated data of *Crassula ovata* may be used as tools for quality control of drugs in the future, for healing of diversity of disease conditions.

Keywords: Phytochemical Screening; *Crassula ovata*; Jade Plant, Pharmacognostic Evaluation; Morphology; Microscopy

1. Introduction

Several ethnic communities in North East India use plants as a source of traditional herbal medicines to treat a wide range of illnesses. since of their distinctive characteristics, medicinal plants are currently viewed as being very important since they represent a major source of therapeutic phytochemicals that have the potential to be developed into new medications.[1]

Jade plan or *Crassula ovata,* is a medicinal herb that has long been used for treating diabetes symptoms. But till date, sporadic attempts have been made for the scientific and methodical validation of these traditional claims. Therefore, the present study was designed to investigate phytochemical screening, antioxidant, antimicrobial and antidiabetic activity of the leaf of *Crassula ovata*.[1] The native plant of South Africa is *Crassula ovata*. Although it is a widespread houseplant worldwide, it is primarily found in the Northern Hemisphere, especially in dry, cold climates with limited water sources. Thanks to Crassulacean Acid Metabolism (CAM), the *Crassula ovata* plant can photosynthesize with minimal water loss. The plant endures droughts, being grazed on, stomped on, or pushed over because of its succulent water-storing leaves, stems, and roots. It can even take root from a single leaf. Any fallen leaves that are left around the base of the plants put down roots and sprout new growth. They can also be chopped, put in a water container to promote the growth of roots (this normally takes two weeks), and then planted in soil. Bees, flies, wasps, butterflies, and beetles are all attracted to the blossoms of *Crassula ovata*. The seeds resemble fine dust and are dispersed by wind. Additionally, wasps can build their nests on the stems.[1] The leaves of *Crassula ovata* were traditionally used to treat warts by slicing

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them in half and applying the moist inside to the wart for a few hours or overnight. Three treatments would be enough to remove the unsightly growth. The jade plant is a popular element in Asian cultures, especially in China (about 700 AD). Diabetes symptoms were treated with a jade plant drink by medicine men. It was utilised in the art of bonsai because of its abundance and softness in ancient times, which allowed it to be easily formed into a variety of forms. The plant was given as an elegant present to aristocrats across the Chinese empire. As is traditional in China, businesses frequently place a jade plant next to the cash register in an attempt to attract prosperity. According to the traditional uses of several communities in North East India, particularly in Manipur, *Crassula ovata* is primarily used to treat infections and diabetes. They used to consume the plant's leaf juice to treat diabetes.[2]

1.1. Morphological description

The jade plant is an evergreen plant up to 1 - 3 m tall, with thick branches and smooth, rounded, fleshy leaves that grow in opposite sides along the branches which are also short, stubby and well-proportioned. The leaves are a rich jade green colour, 30 -90 mm long and 18 - 40 mm wide, egg-shaped to elliptic, often with a red margin and a somewhat pointed end. They are grouped around the extremities of the branches and are organised in opposite pairs, with each pair at a right angle to the other. New stem growth is the same colour and texture as the leaves, but becomes brown and woody with age. They may flower in early spring with tiny, star-shaped white or pink flowers if the correct conditions are provided. The flowers later develop into small capsules, each of which hold many tiny seeds.[2]

1.2. Microscopical description

The microscopy of *Crassula ovata* plant carried out using electron microscope. The plant parts were sliced fine by using microtome for its transverse section and the finest sections were selected for the study. The sections were examined under microscope using ×10 eye piece and objective pieces 10, 40, and ×100. For leaf constants ×5 eye piece and ×10 objective piece were used. Leaves of succulents are often thick, hard and have a fatty aspect. The chlorenchyma is poorly differentiated. The vascular bundles are more or less randomly spread in the leaf and are sectioned here in all orientations. There are few air cavities and the cells seem to be swollen.

An additional layer of wax on the cuticle helps to further reduce water loss. During the day, the stomata close, and at night, they open. As a result, they are found in both the adaxial and abaxial regions and are not sunk in the epidermis. [11]

1.3. Ecology and distribution

The *Crassula ovata* plant is able to maintain minimum water loss while photosynthesizing efficiently through Crassulacean Acid Metabolism (CAM). Its stomata are closed during the day but open at night where Co2 is taken in and stored in the form of organic crassulacean acids. In daytime, these acids are broken down and the Co2 released is recycled in the photosynthetic process. This way the plants lose much less water yet can photosynthesize normally during the daytime hours. However, during extremely dry periods they will not even open their stomata at night, and will re-cycle the Co2 within their cells. This causes slow metabolism hence little growth but at the same time keeping the cells healthy. This is called CAM-idling.

Because it can take root from any part of its stem, even a single leaf, the plant's succulent water-storing leaves, stems, and roots allow it to survive droughts and even graze, trample, and knock over. Any fallen leaves that remain near the plant's base send down roots and sprout new plants. Bees, flies, wasps, butterflies, and beetles are all drawn to the blossoms of *Crassula ovata*. The seeds resemble fine dust and are dispersed by wind. Additionally, wasps can build their nests on the stems.[2]

1.4. Traditional uses and cultural aspects

Traditionally many communities have developed a habit of using the fluid extract from the leaves to treat warts which are small circumscribed tumour of the outer layer of the skin. Warts are flat or elevated from the surrounding skin and are firm. They are caused by forms of the contagious human papilloma virus (HPV); warts vary in size and may be accompanied by pain, particularly if they occur on the feet (plantar warts). After cutting the *Crassula ovata* leaf in half, the moist the inside was applied to the wart for a few hours or overnight. Three treatments would be enough to remove the unsightly growth.[3]

The jade plant is a popular element in Asian cultures, especially in China (about 700 AD). Diabetes symptoms were treated with a jade plant drink by medicine men. It had been used in the art of bonsai because of its abundance and softness in ancient times, which allowed it to be easily created into a variety of forms. The plant was given as an elegant present to aristocrats across the Chinese empire.[4]

The jade plant is used in the Chinese ritual practice of Feng Shui to attract the flow of money. Feng Shui creates balance and harmony of energies within a space. Practitioners believe that the money tree brings about balance to the south-eastern corner of a home. The jade plant is one of the plants used in this ritual practice. As is traditional in China, businesses frequently place a jade plant next to the cash register in an attempt to attract prosperity.[3]

In Africa, jade leaves are boiled in milk and consumed to stop diarrhea. The Khoi and other African tribes ate the roots and stems of the jade plant. The plant was grated and cooked after which they were eaten with thick milk. The leaves were also boiled in milk as a remedy for diarrhoea, treating epilepsy, corns and as a purgative.[3]

For ornamental purposes, the *Crassula ovata* plant is primarily grown in Kenyan homesteads. But some people also preserve this plant for its medicinal properties. The Kamba people believes that the plant's juice can aid in the healing of skin burns. It is used to treat upset stomachs in other communities, such as the Maasai community.[3]

2. Materials and methods

2.1. Sample collection and identification

The whole plant of *Crassula ovata* was collected from local market of Rahata, Maharashtra and was authenticated by Dr. Wabale Anil Sopanrao, Head of Department of Botany, PVP College of Arts, Science and Commerce, Pravaranagar, Maharashtra, India, vide letter number PVPC/2023-24/202 dated 1/11/2023.

2.2. Extraction of crude extracts from the plant

25g of plant powder are extracted by maceration separately with methanol, ethanol, chloroform, Acetone and water during 24 hours, in room temperature with intermittent shaking. The extracts were concentrated till free from the solvents.[5]

Figure 1 Extraction

2.3. Phytochemical tests

2.3.1. Alkaloid test

2.3.2. Mayer's test

A drop or two of Mayer's reagent was applied by the test tube's side to 1 millilitre of the filtrate. A precipitate that is white or creamy signifies a positive test result.[7]

2.3.3. Dragendorff's test

A 1 or 2 ml of Dragendorff's reagent was added to 1 ml of the filtrate. A noticeable yellow precipitate indicates a positive test result.[7]

2.4. Carbohydrate test

2.4.1. Molish

To 1ml filtrate add 2 drops molish reagent and mix well then add conc. Sulphuric acid down side of the tube form the ring at the interface of two layers.[8]

2.5. Detection of saponins

1 ml of plant extracts were dissolved in anhydride-tetrachloride to which 4 drops of concentrated sulfuric acid was added to the mixture. A blue, green or red colour accompanied by a pink ring shows presence of Saponins.[7]

2.6. Flavonoids test

1 millilitre of the extract, four drops of hydrochloric acid, and magnesium turnings were added to a test tube. The appearance of a magenta or pink colour denotes the presence of flavonoids.[9]

2.7. Sterols and steroids test

One ml of the extract was placed in a test tube together with equivalent volumes of acetic anhydride, sulfuric acid, and chloroform (0.5 ml each). A red coloration would indicate presence of sterols. A green colour indicates presence of steroids.[9]

2.8. Test for phenols

A small amount of the extract was taken with 1 mL of water in a test tube and 1 to 2 drops of Iron III chloride (FeCl3) was added. A blue, green, red or purple colour is a positive test.[7]

2.9. Test for glycosides

A small amount of extract was taken in 1 mL of water in a test tube and a few drops of aqueous NaOH were added. A yellow coloration indicates the presence glycosides.[8]

Test for terpenoids

A test tube with 2 millilitres of chloroform was filled with 5 millilitres of extract. Subsequently, 3 mL concentrated H2SO4 is added, creating a layer. Terpenoids are indicated by the interface's reddish-brown tint.[10]

3. Results

In the present investigation, preliminary phytochemical investigation has been done in the different extracts of *Crassula ovata* leaves showed the presence of phytochemical constituents namely alkaloids, anthraquinones, flavonoids, glycosides, saponins, steroids, tannins, triterpenoid, and absence of amino acids, shown in Table I.

The first screening assays for phytochemicals could be useful in identifying and developing new drugs by screening for bioactive substances. Further, these tests make easy their qualitative separation and quantitative estimation of pharmacologically active chemical compounds. The phytochemical screening in the present study has publicized the presence of alkaloids, anthraquinones, flavonoids, glycosides, saponins, steroids, tannins, and triterpenoids in the leaves extract. Further the presence of different phytochemicals in the five different organic solvent extracts may be responsible for the therapeutic properties of *Crassula ovata*.

Among the phenolic chemicals that function as primary antioxidants or free radical scavengers are tannins and flavonoids. Since these phenolic compounds were originated to be present in the extracts, it might be accountable for the potent antioxidant capacity of *Crassula ovata*. The medicinal benefit of these phytochemicals from medicinal plants has been the main focus of research, and it can be useful for therapeutic index. For instance, saponins and glycosides proved as hypotensive and cardio depressant properties, which are helpful for the treatment of congestive heart failure and cardiac myopathy. The occurrence of saponins in benzene and acetone extracts and glycosides in all the extracts of leaves of *Crassula ovata* might play a role in the cardioprotective potential. Alkaloids and tannins may have anti-inflammatory and anti-hyperglycaemic properties. Moreover, the terpenoids and Phenolic acid have also been revealed to decrease blood sugar level in animal studied. Furthermore, the analgesic effects and central nervous system activity of the steroids and triterpenoids were revealed. Therefore, the preliminary phytochemical investigations are useful in

identifying chemical components in the plant material that might aid in their quantitative evaluation as well as in identifying the source of a chemical molecule that is pharmacologically active.

Table 1 The analysis of phytochemical in the different organic extracts of *Crassula ovata* leaves

Sr.no	Test	Ethanol	Methanol	Chloroform	Acetone	Aqueous
1.	Alkaloid					
	1.Mayer's	++	++	-	-	++
	2.Dragendroff's	++	++	+	++	++
2	Phenolic Compound					
	1.Lead acetate	++	++	+	++	-
3.	Tannins	+	++	++	++	++
4.	Carbohydrate					
	1.Molish test	++	-	+	+	+
5.	Glycoside	++	+	+	++	-
6.	Phytosterol					
	Salkowski	++	++	++	++	+
7.	Flavonoid					
	Alkaline	++	++	++	-	-

Morphological characteristics revealed, leaves of succulents are often thick, hard and have a fatty aspect. The chlorenchyma is poorly differentiated. The vascular bundles are more or less randomly spread in the leaf and are sectioned here in all orientations. There are few air cavities and the cells seem to be swollen. An additional layer of wax on the cuticle helps to further reduce water loss. During the day, the stomata close, and at night, they open. As a result, they are found in both the adaxial and abaxial regions and are not sunk in the epidermis.

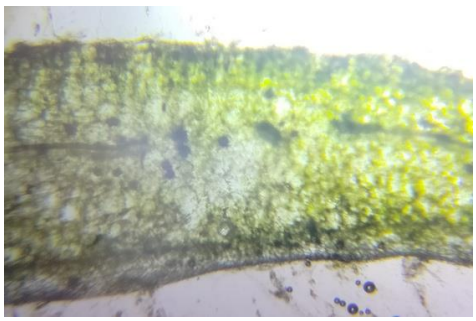

Figure 2 Microscopy

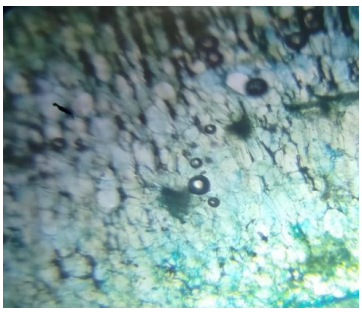

Figure 3 Microscopy

The plant showed total 15%, its moisture content on dry weight basis was found to be 40% and its total yield of extract found to be 15.0575%.

Table 2 Physical constant of *Crassula ovata* leaves

Sr.no.	Constant	Percentage
1.	Total Ash	15%
2.	Moisture content	40%
3.	Total Extract	15.0575%

4. Discussion

According to their morphological features, succulent leaves are frequently thick, rigid, and have a fatty component. There is little differentiation in the chlorenchyma. The vascular bundles are sectioned here in all directions and are distributed in the leaf almost randomly. The cells appear bloated, and there aren't many air spaces. An additional layer of wax on the cuticle helps to further reduce water loss. During the day, the stomata close, and at night, they open. As a result, they are found in both the adaxial and abaxial regions and are not sunk in the epidermis.

The entire study was carried out by using both aqueous and methanol extract of leaves of *Crassula ovata*. The preliminary phytochemical screening tests for the ethanol, methanol, chloroform, acetone and aqueous extract of *Crassula ovata* leaves (Table 1) revealed the presence of several bioactive compounds which could be responsible for the diverse medicinal properties of this plant. Presence of Saponin, phytosterol, Phenol, Steroid, Terpenoid, Flavonoid, carbohydrate and Protein were seen in the extracts of the plant. Presence of any of the secondary metabolites, singly or in combination with others could be responsible for the anti-diabetic activity of the plant.

The percentage of loss of weight on drying, total ash and total extract were obtained by employing standard methods of analysis. Not much work has been done on the plant Crassula ovata to evaluate its efficacy in scientific way which is traditionally being used by Manipuri people (Manipur, India) for a long time to cure diabetes. The findings of this work would help in future large scale studies. Humans have depended on plants for many of their basic requirements, including the production of medicines that can save lives. However, intentional attempts towards domestication and culture are crucial for the ongoing availability of these plant species, as medicinal plants are endangered due to human impact and unregulated wild collecting. The number of persons suffering with conditions such as diabetes, diarrhoea, cancer, rheumatism, inflammation, jaundice, hepatic blockage, pain, cold, cough, etc. is on the rise in many countries these days. The condition can be successfully treated using treatments made from medicinal herbs.

5. Conclusion

The macroscopy, microscopy, and study of physical constants of the plant *Crassula ovata.* were performed. The results of phytochemical analysis showed the leaves extracts of *Crassula ovata* indicates their potential as a source of bioactive principles that may supply drugs for modern medicines. Further studies are therefore required to validate their antimicrobial, antidiabetic, antihyperglycemic, anti-inflammatory, anthelminthic activities. To make the plant attractive for innovative studies, isolation, purification, and characterisation of the active components are also required.

Compliance with ethical standards

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Disclosure of conflict of interest

Authors have no conflict of interest to declare.

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