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A COMPREHENSIVE REVIEW ON PHARMACOGNOSTICAL AND PHYTO-PHARMACOLOGICAIL OF *OXYSTELMA ESCULENTUM*

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ABSTRACT

Oxystelma esculentum R. Br., a valuable medicinal plant, has been traditionally used in Ayurvedic medicine for various ailments, including bronchitis, gonorrhea, and skin conditions. Despite its rich phytochemical composition and pharmacological activities, the plant remains under-exploited and under-researched. The current study focussed on comprehensive overview of the plant traditional uses, phytochemistry, pharmacology, and future prospects. The *Oxystelma esculentum* phytoconstituents, including flavonoids, cardenolides, and phenolics, have been found to possess antioxidant, antibacterial, anti-inflammatory, and diuretic activities. The *Oxystelma esculentum* extracts have been shown to exhibit significant pharmacological activities, including diuretic, antibacterial, antioxidant, and anti-inflammatory effects. The review highlights the need for further research on the plant's medicinal potential, particularly at the cellular and molecular levels. The development of novel extraction methods, pharmacological screening, and clinical trials are essential to fully exploit the *Oxystelma esculentum* therapeutic potential. A medicinal plant review serves as a foundation for future research on *Oxystelma esculentum*, which could lead to the development of novel drugs and therapies for various diseases.

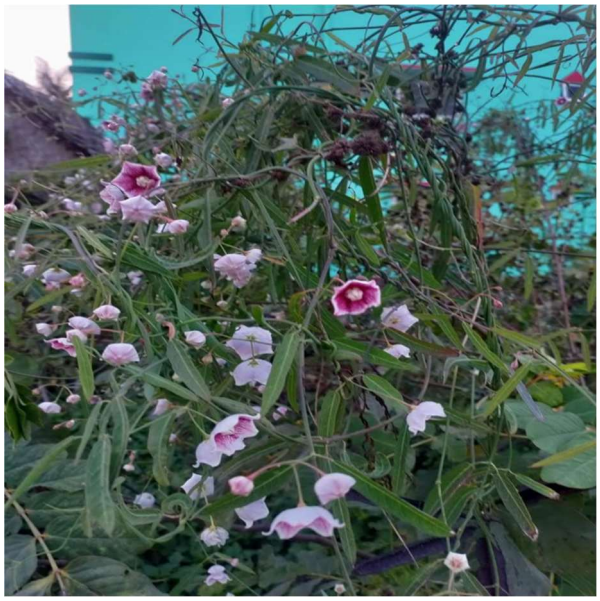
Keywords: *Oxystelma esculentum*, extraction, isolation, Anti-inflammatory, Antioxidant activity, Epicatechin, kaempferol

INTRODUCTION & BACKGROUND

Medicinal plants are a very valuable source of a diverse range of secondary metabolites that are employed as food additives, agrochemicals, tastes, perfumes, colors, and biopesticides **[1]**. A common Ayurvedic plant that has not received enough attention is *Oxystelma esculentum* R. Br. (Family: Asclepiadaceae), often known as "Jaldudhi." **[2]** *O.esculentum* is currently more in demand in traditional medical systems due to advances in medical knowledge and the discovery of its numerous medicinal benefits, which has also had an impact on the plant's wild state. *O.esculentum* is traditionally mostly propagated by seeds, yet these have low germination and viability rates. As such, it is not a productive method of preserving this vital medical plant. Therefore, in order to satisfy the increased **[3]**market demand, it is imperative that new efforts be made to create *O.esculentum* succulent plants by artificial propagation techniques **[4]**. The plant has a number of pharmacological effects, including aphrodisiac, anthelmintic, diuretic, and bronchitis. The fruit has anthelmintic and expectorant properties, and its juice is used to treat gonorrhea and muscle discomfort **[5]**. *O.esculentum* latex, a bitter material with strong antiperiodic effects, is harvested, dried, and applied as a vulnerary .

Plant Description:

Oxys means "sharp" and Stella means "crown," therefore Oxys means "sharp crown." This weed climbs with a tall, cylindrical, glabrous, weak stem that has many branches. The leaf is simple, as seen in the figure below, lanceolate, opposite, and linear, typically measuring 9 cm by 0.6 cm in length with a sharp apex and a lengthy petiole. The inflorescence is sub-umbellar and solitary. The pink flowers have a purple vein running through them. Their diameter ranges from 2.4 to 5.5 cm, and they hang downward, as seen in the image below. The insides of the calyx and corolla are oblong, glandular, hairless, and shaped like a cone with five sepeoules. The corolla is composed of five petals with a smooth surface, approximately 3.0 cm in width **[6]**.



LEAF & FLOWER OF *OXYSTELMA ESCULENTUM*

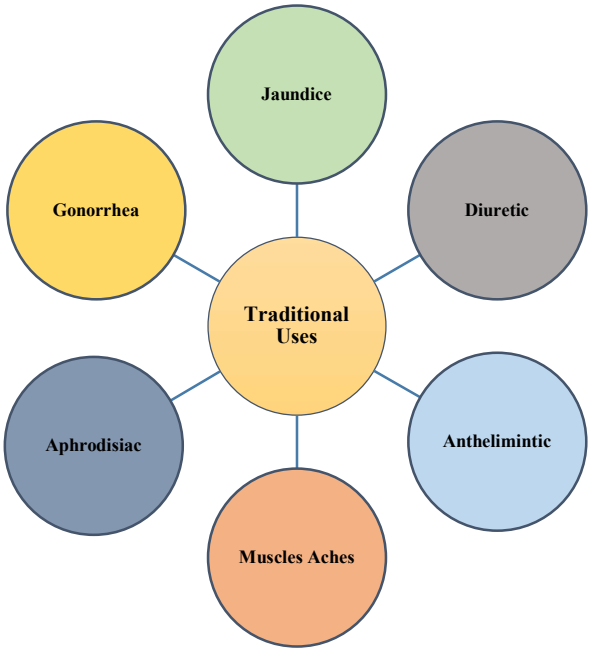
FLOWER OF *OXYSTELMA ESCULENTUM*

Taxonomic classification;[2]

Kingdom : Plant
Division : Phanerogams
Subdivision : Angiosperms
Class : Dicotyledons
Subclass : Sympetalae/gamopetalac
Order : Gentianales
Family : Asclepiadaceae
Genus : Oxystelma
Species : *Oxystelma esculentum* R.Br.

Traditional uses:

For basic preventive and curative treatment, traditional healers employ 2500 plant species. During times of famine, the impoverished would consume the roots, leaves, and fruits of *Oxystelma esculentum* (L. f.), a phytochemically rich and medicinally beneficial plant. All parts of the plant can be consumed, and a decoction of it is applied topically to cure hepatitis, skin conditions, and phathous ulcers. Both the latex and the roots have antibacterial and vulnerary qualities; the roots are useful for jaundice. The milk sap is applied as an ulcer wash, and the root is said to be particular for jaundice **[7]**. The plant has several Ayurvedic uses, including diuretic, aphrodisiac, anthelmintic, and anti-bronchitis; it is also beneficial for leucoderma **[8]**.



Review of Extraction Methods Reported in the *Oxystelma esculentum*

Sherif *et al*. reported that *Oxystelma esculentum* was extracted using methanol for 12 hours with the help of soxhlet apparatus and extract was refrigerated between 4°C -20°C **[9]**.

Durairaj *et al*. reported that dried aerial plant material were ground into a powder, then defatted at 60–80°C using petroleum ether, and then extracted using methanol in a Soxhlet apparatus for a full 72 hours. Following a reduction in pressure and controlled temperature (50–60°C), the extract was concentrated to dryness to

produce a dark green semi-solid (yielding 14.60% w/w), which was then refrigerated. After dissolving the methanol extract in distilled water **[10]**.

Pandya *et al*. reported that Successive extraction of plant powder was extracted using four solvents are petroleum ether, chloroform, methanol, and distilled water in a round-bottom flask below 50 °C **[11]**.

Pandya *et al*. reported the successive extraction of plant powder using four solvents in the decreasing order of their polarity index: petroleum ether, chloroform, methanol, and distilled water. The dried extracts yielded 10.1% w/w, 8.5% w/w, 7.5% w/w, and 14.1% w/w. Then, for further investigation of each activity **[12]**.

Maliga *et al*. extracted *O.esculentum* using a Soxhlet apparatus, the powdered materials were extracted at 470 °C. As a solvent, acetone, chloroform, and ethanol were used. The extract was dried at 500 °C in a hot air oven following extraction. Samples that were extracted were kept in a suitable manner and can be utilized for antibacterial activity against respiratory tract infection **[13]**.

Selvakumar *et al*. reported that the dried leaves were powdered and then extracted using acetone, benzene, chloroform, hexane, and methanol (500 ml, Ranchem) in a Soxhlet apparatus until all of the solvents were used. "Rotavapour" concentrated the extract at 45°C with a lowered pressure of 22–26 mmHg, and the resulting residue was kept at 4°C **[14]**.

Kumar *et al*. extracted *Oxystelma esculentum* with distilled water by filtering out the suspended contaminants. The aqueous extract was served as a corrosion inhibitor **[15]**.

Table 1: Pharmacological activity of *O.esculentum*

PLANT NAME	PART USED	SOLVENT USED	EXTRACT METHOD	ACTIVITY
Oxystelma esculentum	Pulverized plant	Ethanol	Soxhlet extraction	Anti-inflammatory, analgesic, and antipyretic
Oxystelma esculentum	Aerial plant	petroleum ether	Soxhlet extraction	Antineoplastic and antioxidant activities
Oxystelma esculentum	Flower and Fruit	Petroleum ether, chloroform, methanol	Successive extraction	Anti-ulcer
Oxystelma esculentum	Flower and Fruit	Petroleum ether chloroform, methanol	Successive extraction	Diuretic activity
Oxystelma esculentum	Stem and leaf	Ethanol, chloroform, acetone	Soxhlet extraction	Antimicrobial activity
Oxystelma esculentum	Leaf	Acetone, benzene, chloroform, hexane and methanol	Soxhlet extraction	Larvicidal activity
Oxystelma esculentum	Leaf	Distilled water,	Aqueous extract	None

Pharmacognostical studies:

Savitha *et al*. studied the microscopic parameters includes characteristic features such as cork in surface view, a high concentration of calcium oxalate rosette crystals in parenchymatous tissue, and various thickenings in xylem arteries. In the cortical region, there are calcium oxalate crystals of the diffuse variety and no starch grains. The vessel's components are wide, round, have simple pits on their tails, and are placed in a diffuse porous structure with solitary pores. Phytochemical studies revealed that flavonoids, phenolics, Cardenolides and sugars were determined by phytochemical screening **[16]**.

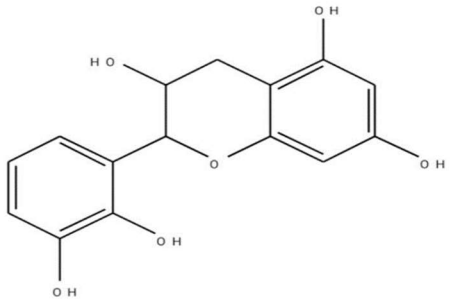
Phytochemistry Extraction Method of Compound Isolated

Pandya *et al*. the phytoconstituents includes flavanoids, cardica glycosides, phenols, triterpenoids, steroids, cardenolides, are present and alkaloids, saponion, glycosides, gums, carotenoids are absent in petroleum ether extract of *Oxystelma esculentum* **[17]**.

Preliminary Phytochemical Study Showed Compound

Heneidak *et al*. Flavanol glycosides were isolated from the methanolic extract of *Oxystelma esculentum* using column chromatography, in which n-butanol, acetic acid, and water were used as solvents in a ratio of 4:1:5, and fractions were purified by semi-preparative High-performance liquid chromatography and analytical High-performance liquid chromatography, in which methanol (100% High-performance liquid chromatography grade) and water (100% High-performance liquid chromatography grade) are used as solvents A and B **[18]**.

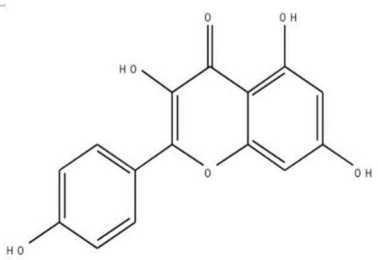
Pandya *et al*. isolated Epicatechin from the dried methanolic extract underwent pilot Thin layer chromatography experiments using various solvents. After observing the results, was subjected to column chromatography and elution using toluene and ethyl acetate. 200 fractions were collected, and pure crystals of a compound were obtained after evaporation of the mobile phase **[19]**.



Epicatechin

Pandya *et al*. isolated kaempferol from *O.esculentum* by HPTLC. A precoated silica gel 60 F254 plate served as the

stationary phase, and toluene:methanol (3.5:6.5) served as the mobile phase. The ascending separation method was used, and detection was done within the UV range **[20]**.



kaempferol

Pharmacological activity:

Diuretic activity:

Pandya *et al*. investigated a methanolic extract of *O.esculentum* leaves to study the effects of diuresis in male Wistar albino rats, Electrolyte excretion (sodium ion, potassium, calcium, and chlorine) and urinary output were monitored. *O.esculentum* is an effective, hyperchloremic diuretic, hyperkalaemic, hypercalaemic, and hyperkalaemic as evidenced by the dose-dependent methanolic extrat's considerable increase in urine production and significant impact on the electrolyte balance **[2]**.

Antibacterial activity:

Sabitha *et al*. assessed antibacterial activity by adding sterile liquid nutritional agar medium were added to each sterile petri plate. Nutrient agar plates were covered with 100 ml of suspension containing 108 CFU/ml of each test microorganism once the suspension had solidified. The filter paper discs were kept over inoculated agar and 10 ml of the 3 mg/ml extracts were impregnated into each disc. Using the same solvents used to dissolve the plant extract, negative controls were created. To find out how sensitive the plant extract was to each type of bacterium, 30 mg/disc of chloramphenicol was utilized as a positive reference control. The infected plates were incubated for twenty-four hours at 37°C. The zones of inhibition against the test organisms were measured in order to assess the antibacterial activity. Every test was carried out in triplicate **[5]**.

Antioxidant activity:

Sherif *et al*. performed antioxidant activity of *O.esculentum* for figuring out whether phytocompounds can act as free radical scavengers or Hydrogen donors in the DPPH(2,2-diphenyl-1-picrylhydrazyl) assay. The findings demonstrated that OEE has notable antioxidant capacity in the assays for DPPH(2,2-diphenyl-1-picrylhydrazyl) (266.3 ± 7.35 µmol TE/g), ABTS (1066.3 ± 7.53 µmol TE/g), and FRAP (483.6 ± 3.84 µmol TE/g) **[9]**.

Antimicrobial activity:

Maliga *et al*. studied antimicrobial activity of *O.esculentum* in this experiment, the following microorganisms were used: *Aspergillus niger, Cryptococcus, Candida albicans, fungi, neoformans, and Mucor sp.; bacteria, Escherchia coli, Klebsiella pneumonia, Pseudomonas aeruginosa, Staphylococcus aureus*, etc. Based on Perez *et al*. (1990), the well-diffusion method was used to measure antibacterial activity. Twenty millilitres of sterile Mueller Hinton Agar were used to make petri plates for the growth of bacteria. On top of the solidified media, the test cultures (105 dilution) were swabbed, and they were given 10 minutes to dry. Using a sterile well borer (6 mm dia.), wells were created in the seeded plates following the media's solidification. Growth inhibition zones were measured 24 hours after incubation at 370 °C. Wells were filled with 25, 50, 75, and 100µl of the ethanolic and CC fractions of stem, leaves, stem callus, and leaf callus extract. The experiment was conducted twice, and the zone of inhibition was measured in millimeters **[13]**.

Anti-inflammatory:

Sherif *et al*. worked on anti-inflammatory activity of *Oxystelma esculentum*. The in vitro study was carried out in which the ethanolic extract of *Oxystelma esculentum* inhibited lipoxygenase enzymes, which are responsible for the inflammatory response. In the in vivo study, carrageenan-induced paw edema was used as a screening method, and *Oxystelma esculentum* reduced the paw edema in animals. The study demonstrated that the ethanolic extract of *Oxystelma esculentum* has Anti-inflammtory activity. To assess the analgesic activity of *Oxystelma esculentum*, several assays were conducted, including the hot plate method, the tail flick method, the formalin nociceptive assay, and the writing test. These methods confirm that *Oxystelma esculentum* has analgesic properties. The antipyretic activity was assessed using a yeast-induced pyrexia model in rats. *Oxystelma esculentum* reduced the rectal temperature in rats, which indicates *Oxystelma esculentum* has antipyretic activity **[9]**.

CONCLUSIONS:

The present review highlights a major gap in the understanding and advancement of *Oxystelma esculentum*, a medicinal herb. In addition to its rich nutritional content and potential traditional uses, the plant has a plethora of biological research areas that require additional investigation and study. A comprehensive systematic phytochemical and pharmacological investigation has not

yet been conducted, despite the fact that several phytochemical and pharmacological activities of *Oxystelma esculentum* have been studied by researchers worldwide, supporting its extremely limited medical potential. Because more research is needed to fully understand this plant's medicinal potential, especially at the cellular and molecular levels, our evaluation has focused attention on the little amount of research that has been done on it.

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