

Medicinal Importance and Pharmacological Potential of *Oxystelma esculentum* (L.f.) Sm.: A Review

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Abstract

Oxystelma esculentum (L.f.) Sm., commonly known as rosy milkweed vine, is a traditionally important medicinal plant belonging to the family Apocynaceae. It is mainly found in moist, marshy, and water-associated habitats and has been traditionally used for the treatment of various ailments. Different parts of the plant have shown several pharmacological activities, including diuretic, laxative, antitussive, anthelmintic, antibacterial, antioxidant, anti-inflammatory, analgesic, antipyretic, hepatoprotective, and anticancer effects. Phytochemical studies have identified various bioactive constituents such as alkaloids, flavonoids, tannins, phenolics, steroids, terpenoids, saponins, cardiac glycosides, cardenolides, and pregnane glycosides. Cardenolides such as oxystelmoside, oxyline, and oxystelmine have also been isolated from the plant. The reported biological activities indicate that *O. esculentum* possesses considerable therapeutic potential, which may be attributed to its diverse phytochemical constituents. However, detailed phytochemical characterization, toxicity studies, mechanistic investigations, and clinical evaluations are still limited. Therefore, the present review summarizes the botanical features, distribution, traditional uses, phytochemical constituents, and pharmacological activities of *O. esculentum*, with emphasis on its therapeutic potential and scope for future research.

Key words: *Oxystelma esculentum* leaves, Traditional uses, Pharmacological activities.

INTRODUCTION

Plants are indispensable to the survival of humans and animals and represent an important component of the natural environment. The plant kingdom exhibits enormous diversity, comprising more than 500,000 known botanical species. This rich plant diversity contributes substantially to biodiversity and plays an essential role in maintaining ecological balance, environmental sustainability, and ecosystem functioning. Among the various systems of healthcare, herbal medicine is considered one of the oldest forms of treatment and has been practiced since ancient civilizations, including ancient Greece, where its use can be traced back to approximately 1600 BC

In recent years, there has been a renewed worldwide interest in medicinal plants and traditional systems of medicine, often referred to as the herbal renaissance. India possesses a particularly rich heritage of medicinal plant utilization. Ethnobotanical studies have reported that more than 6,000 higher plant species are used in Indian traditional and folk healthcare practices, accounting for approximately 40% of the country's higher plant diversity. For centuries, medicinal plants have served as an important source of therapeutic agents and continue to form the basis of traditional healthcare systems in different parts of the world. ^[1]

Oxystelma esculentum (L.f.) Sm. is one such medicinal plant that has received comparatively less scientific attention despite its traditional importance. It has been used in traditional medicine for various therapeutic purposes and is recognized for its diverse pharmacological properties. The plant is commonly known as the “rosy milkweed vine” and belongs to the perennial twining group. It is predominantly found in the plains of the Indian subcontinent, particularly in moist and waterlogged habitats.

The name *Oxystelma* is derived from the Greek terms “Oxys,” meaning sharp, and “Stelma,” meaning crown, which refers to the characteristic sharp crown-like structure of the plant. Traditionally, *Oxystelma esculentum* has been utilized for several medicinal purposes. Reported traditional applications include its use as a laxative, antiseptic, depurative, anthelmintic, antiulcer, aphrodisiac, and hepatoprotective agent. It has also been traditionally associated with the management of conditions such as leucoderma and bronchitis. ^[2]

Considering its diverse traditional applications, *Oxystelma esculentum* represents a promising candidate for further pharmacological investigation. A comprehensive review of the available literature from scientific journals, books, and reliable online sources can provide valuable information regarding its phytochemical constituents, traditional uses, and reported biological activities. Such information may help identify existing research gaps and provide a scientific basis for future studies on the therapeutic potential of *Oxystelma esculentum*.

PLANT DESCRIPTION

The genus name *Oxystelma* is derived from the Greek words “Oxys,” meaning sharp, and “Stelma,” meaning crown, referring to its characteristic sharp crown-like structure. *Oxystelma esculentum* (L.f.) Sm. is a climbing herb with a long, cylindrical, smooth, weak, and highly branched stem.

The leaves are simple, opposite, linear to lanceolate in shape, and generally about 9 cm long and 0.6 cm wide. They possess a pointed apex and a relatively long petiole. The inflorescence is generally solitary and sub-umbellate. The flowers are pink with prominent purple veins and are widely spreading, measuring approximately 2.4–4.55 cm in diameter. The flowers are characteristically pendulous.

The calyx consists of five sepals, which are free, cone-shaped, oblong, and glandular on the inner surface. The corolla comprises five petals, approximately 3 cm wide, with a smooth surface and a widely rotating arrangement. The androecium contains five stamens, which are positioned near the base of the corolla. The filaments are connate and become united toward the base.

The fruit occurs as follicles measuring approximately 5–8 cm in length. They are generally solitary, smooth, and oval to lanceolate in shape. Each follicle contains numerous seeds, which are characteristically blackish and oval in appearance. ^[3]



Oxystelma esculentum (L.f.) Sm

VERNACULAR NAME:

Tamil : Usipallai

Telugu : Dudipala

Marathi: Dudhani, Dudhika

Bengali: Khirai, Dudhialata

Gujarati: Jaldudhi

Hindi : Dudhalata

Sanskrit: Dugdhika, Tiktadugdha

TAXANOMICAL CLASSIFICATION:

Kingdom : Plantae

Division : Phanerogans

Subdivision: Angiosperms

Class : Dicotyledons

Sub class : Sympetalae/ Gamopetalae

Order : Gentianales

Family : Asclepiadaceae

Genus : Oxystelmma

Species : Oxystelma esculentum (L.f) Sm ^[4]

BIOACTIVE COMPOUNDS

Phytochemical studies of *Oxystelma esculentum* have identified a broad range of secondary metabolites that may contribute to its various therapeutic activities. The plant has been reported to contain alkaloids, flavonoids, tannins, phenolic compounds, steroids, terpenoids, cardiac glycosides, saponin glycosides, reducing sugars, and other bioactive constituents.

Several cardenolides have been isolated from the roots of *O. esculentum*. These include oxystelmoside, a diglycoside of uzarigenin; oxyline, a tetraglycoside of 3-epi-uzarigenin; and oxystelmine, a diglycoside of periplogenin. Although these compounds demonstrate the phytochemical richness of the plant, its complete chemical profile and contribution to its medicinal effects have not yet been fully established.

Further phytochemical investigations are therefore required to isolate, identify, and characterize the active constituents of *O. esculentum*. In addition, standardized extraction procedures and well-designed pharmacological and clinical studies are necessary to establish its safety, therapeutic effectiveness, and potential application in modern drug development. [5]

MEDICINAL VALUES

Oxystelma esculentum has traditionally been associated with several medicinal properties, including antitussive, laxative, spermatogenic, diuretic, antileprotic, and anthelmintic activities. It has also been reported to support female fertility. The whole plant has traditionally been used for hepatoprotective purposes and in the management of inflammatory conditions of the lungs and various skin disorders, including leucoderma. [6]

Preparations such as decoctions of the plant have traditionally been used for conditions such as ulcers, sore throat, itching, and infections of the mouth and throat. The fruit has been described as having tonic, antitussive, and anthelmintic properties and has also been used traditionally for muscle spasms and certain skin disorders. [7]

The presence of cardenolides and pregnane glycosides is particularly significant because these represent important classes of pharmacologically active phytoconstituents. The plant has additionally been reported to possess antiseptic, depurative, and galactagogue properties. Despite its wide range of traditional applications, *O. esculentum* remains comparatively under-investigated and requires further systematic scientific evaluation [5].

DISTRIBUTION

Oxystelma esculentum is distributed across several tropical and subtropical regions, with a greater occurrence reported in coastal and moist environments. It has been documented in countries including Bangladesh, Cambodia, China, Egypt, Indonesia, Iraq, Laos, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, and Vietnam, as well as regions of Northeast Africa and Southwest Asia. [6]

Within India, the plant has been reported from several states, including Gujarat, Maharashtra, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Bihar, and Odisha. It is generally recognized as an amphibious climbing

plant and is commonly found in marshy habitats, along the edges of ponds, lakes, swamps, and other water bodies.

The plant frequently grows with its roots partially immersed in water while climbing over surrounding vegetation. It occurs mainly in the plains and lower hill regions of India and can also be observed in paddy fields, hedges, and areas adjoining semi-marshy habitats. Along riverbank environments, it may climb over other vegetation such as *Tamarix dioica* and *Ipomoea carnea*.

SPOT IDENTIFICATION

Oxystelma esculentum can be recognized as a herbaceous twining climber that produces a characteristic milky latex. Its leaves are arranged oppositely at the internodes and possess sharply pointed tips. The flowers are distinctive, with pink to purple coloration and prominent purple venation on the inner surface. The petals have pointed and hairy tips, while pollinia are present within the flowers. The plant produces follicular fruits containing numerous seeds. When viewed from a distance during flowering, the plant may resemble an orchid because of the appearance and arrangement of its flowers. ^[8]

PHARMACOLOGICAL REVIEW

1. Diuretic Activity

Pandya et al. evaluated the diuretic potential of a methanolic leaf extract of *O. esculentum* using male Wistar albino rats. The study assessed urinary volume and the excretion of electrolytes, including sodium, potassium, calcium, and chloride ions. The methanolic extract produced a dose-dependent increase in urine output and significantly influenced electrolyte excretion. These findings indicated that *O. esculentum* possesses significant diuretic activity along with effects on urinary electrolyte balance. ^[9]

2. Antibacterial Activity

O. esculentum plant extracts against selected microorganisms using the agar disc diffusion method. Nutrient agar plates were inoculated with standardized microbial suspensions, followed by placement of extract-treated filter paper discs on the inoculated medium. Appropriate negative controls containing the respective solvents were included, while chloramphenicol was used as the positive control.

The inoculated plates were incubated at 37°C for 24 hours, after which the zones of inhibition produced by the extracts were measured the *O. esculentum* plant extracts shows significant anti- bacterial activity. ^[10]

3. Antioxidant Activity

Sherif et al. investigated the antioxidant properties of *O. esculentum* by evaluating its ability to neutralize free radicals and act as a hydrogen donor. Different antioxidant assays, including DPPH, ABTS, and FRAP, were employed for the assessment. The extract proved to have considerable antioxidant capacity in all the above tested methods. ^[11]

4. Anti-inflammatory, Analgesic and Antipyretic Activities

Sherif et al. evaluated the anti-inflammatory potential of *O. esculentum* using both in vitro and in vivo experimental approaches. In vitro investigations demonstrated inhibition of lipoxigenase enzymes by the ethanolic extract, suggesting a possible mechanism for its anti-inflammatory action. In vivo assessment using the carrageenan-induced paw edema model showed a reduction in paw swelling following administration of the extract.

The analgesic potential of the plant was further evaluated using different experimental models, including the hot-plate, tail-flick, formalin-induced nociception, and writhing tests. The findings supported the presence of analgesic activity.

Antipyretic activity was evaluated using a yeast-induced pyrexia model in rats. Administration of *O. esculentum* resulted in a reduction in elevated rectal temperature, indicating its potential antipyretic effect. ^[11]

5. Hepatoprotective Activity

Pingili et al reported that methanolic extract of *O. esculentum* exhibited significant hepatoprotective activity against paracetamol-induced liver injury in rats at doses of 200 and 400 mg/kg. The extract enhanced GSH, SOD, and CAT levels while reducing lipid peroxidation, bilirubin, and serum biochemical markers of hepatic injury. The authors suggested that the hepatoprotective effect was mainly associated with the antioxidant potential of the extract. ^[12]

6. Anticancer Activity

Khan et al. reported that methanolic leaf extract of *O. esculentum* exhibited significant anticancer activity against Ehrlich ascites carcinoma in Swiss albino rats. The extract reduced tumor volume, viable tumor cell count, and lipid peroxidation while improving RBC, hemoglobin, and altered WBC levels. Changes in gonadotropic hormones were also observed, suggesting the potential anticancer and antioxidant effects of *O. esculentum*. ^[13]

7. Laxative Activity

Pandya et al. evaluated the laxative potential of *Oxystelma esculentum* using different solvent extracts in experimental Wistar rats. The plant material was successively extracted with solvents of different polarities, and the resulting extracts were subjected to pharmacological evaluation using established laxative models. Among the extracts tested, the petroleum ether extract demonstrated the highest laxative activity and produced an effect comparable to the standard laxative preparation. Phytochemical analysis of the extract indicated the presence of cardenolides, flavonoids, phenolic compounds, sterols, and triterpenoids. The study provided experimental evidence supporting the traditional use of *O. esculentum* as a laxative and suggested that its bioactive phytoconstituents may contribute to the observed pharmacological effect. ^[14]

8. Invitro antidiabetic activity

Thangaraj Francis Xavier et al. evaluated the in vitro antioxidant, antibacterial, and antidiabetic activities of *Oxystelma esculentum* leaf extracts along with in silico molecular docking of selected phytoconstituents. The ethyl acetate extract exhibited high phenolic and flavonoid contents, while ethanol and acetone extracts demonstrated significant α -amylase and α -glucosidase inhibitory activities, respectively. GC-MS analysis identified several phytochemicals, and solanesol showed favourable molecular interaction with the selected diabetes-related target proteins. The study suggested that *O. esculentum* leaves possess considerable pharmacological potential due to their diverse phytoconstituents. ^[15]

9. Bone fracture-healing activity

Rawat et al. evaluated the fracture-healing activity of a flavonoid-enriched fraction (Oxy50-60F) of *Oxystelma esculentum* in a drill-hole femoral injury model in Swiss mice. Oxy50-60F administered at 1, 5, and 10 mg/kg/day enhanced callus formation, bone regeneration, mineralization, and bone microarchitecture in a dose-dependent manner. The treatment also reduced reactive oxygen species through increased SOD2 expression and enhanced osteogenic and anti-inflammatory gene expression. UPLC-MS analysis identified quercetin, kaempferol, and isorhamnetin glycosides in the active fraction. The study demonstrated the potential of *O. esculentum* flavonoids in promoting bone regeneration and fracture healing. ^[16]

10. Anti-ulcer activity

Pandya et al. investigated the anti-ulcer potential of *Oxystelma esculentum* in Wistar rats using aspirin-induced and ethanol-induced acute gastric ulcer models. The plant was successively extracted using solvents of varying polarities, and the different extracts were evaluated for anti-ulcer activity. Among the extracts tested, the petroleum ether extract exhibited the most effective anti-ulcer activity, supporting the traditional use of *O. esculentum* in the treatment of stomach ulcers. Phytochemical screening of the active extract revealed the presence of cardenolides, flavonoids, phenolic compounds, sterols, and triterpenoids. The authors suggested that these phytoconstituents may contribute to the observed gastroprotective effect and concluded that bioactivity-guided phytochemical studies could facilitate the isolation of pharmacologically active compounds from *O. esculentum*. ^[17]

Conclusion

Oxystelma esculentum (L.f.) Sm. is a promising medicinal plant with considerable ethnomedicinal and pharmacological importance. Its diverse phytochemical constituents, particularly flavonoids, phenolics, terpenoids, steroids, cardenolides, and glycosides, are associated with a broad range of biological activities. The available literature supports its potential in the management of several health conditions and highlights the plant as a valuable source of natural bioactive compounds. Despite these encouraging findings, the available scientific evidence is mainly based on preliminary and experimental studies, while systematic investigations on safety, pharmacological mechanisms, standardization, and clinical efficacy remain limited.

Further research integrating phytochemistry, pharmacology, toxicology, and clinical studies is therefore necessary to validate its traditional applications and explore its potential for therapeutic development. Overall, *O. esculentum* represents a promising medicinal plant for future research and development of plant-based therapeutic agents.

References

1. John PP, Sakunthala M, Amster RL, Muthupetchi S. Screening of preliminary phytochemical analysis of *Oxystelma esculentum* R. Br. American Journal of Biological and Pharmaceutical Research. 2017;4(1):10-3.
2. Chishti AW, Akram M, Rehman U, Khan FS, Iftikhar M, Umaru IJ. Phytochemistry and pharmacology of *Oxystelma esculentum*. [African Journal of Biochemistry and molecular research]. [2025] doi: <https://doi.org/10.58578/AJBMBR.v2i2.5269>
3. Kirtikar KR, Basu BD. Indian medicinal plants. Vol. 3. New Delhi: Periodical Experts; 1975.
4. Pandya DJ, Anand IS. A Complete Review on *Oxystelma esculentum* R. Br. Pharmacognosy Journal. 2011 Jan 1;3(19):87-90.
5. Kavita, Singh R, Chauhan J, Mishra S, Singh B. *Oxystelma esculentum* (L.f.) Sm.: phytochemical insights and traditional medicinal uses.
6. Chishti AW, Fatima B, Akram M, Sultana S, Amer MM, Mbaye EH, Ozdemir FA, Kilic O, Voitenkov V, Ekusheva E, Chelladurai G. Phytochemical reviews about *Oxystelma esculentum*. Annals of Pharma Research. 2021 Nov 28;9(6).
7. Sharma L, Prasad R. phytochemical screening for various primary and secondary metabolites of *Oxystelma esculentum* R.Br.
8. Panda M. Field identification and phytochemical uses of *Oxystelma esculentum* (Lf) Sm.: a rare wetland climber of Odisha State, India. J. Pharmacogn. Phytochemistry. 2019;8(3):3730-7.
9. Durairaj AK, Mazumder UK, Gupta M, Ray SK. Effects of methanolic extract of *Oxystelma esculentum* on diuresis and urinary electrolytes excretion in rats. Iran J Pharmacol Ther. 2007 Nov 10; 6:207-11.
10. Kumar MS, Chaudhury S, Balachandran S. In vitro micropropagation of *Oxystelma esculentum* R. Br.–a medicinal herb. International Journal of Biotechnology & Biochemistry. 2009;5(2):147-56.
11. Sherif AE, Sajid-ur-Rehman M, Asif M, Qadeer I, Khan KU. Anti-inflammatory, analgesic, and antipyretic potential of *Oxystelma esculentum* (L. f.) Sm. using in vitro, in vivo, and in silico studies. Frontiers in Pharmacology. 2024 Jan 16; 14:1326968.
12. Durairaj AK, Vaiyapuri TS, Mazumder UK, Gupta M. Hepatoprotective and inhibition of oxidative stress in liver tissue of *Oxystelma esculentum* on paracetamol induced hepatic damage in rats. Pharmacologyonline. 2007; 3:52-72.
13. Durairaj AK, Vaiyapuri TS, Mazumder UK, Gupta M. Antineoplastic and antioxidant activities of *Oxystelma esculentum* on Swiss albino mice bearing Ehrlich's ascites carcinoma. Pharmaceutical Biology. 2009 Mar 1;47(3):195-202.
14. Pandya DJ, Anand IS. Evaluation of laxative activity of *Oxystelma esculentum*. Pharmacognosy Journal. 2011 Aug 1;3(24):81-3.
15. Xavier TF, Sabitha R, Balavivekananthan S. In vitro pharmacological investigations of *Oxystelma esculentum* R. Br. and in silico molecular docking analysis of its leaf constituents on diabetic related target. South African journal of botany. 2022 Sep 1; 149:320-38.
16. Rawat P, Sharma K, Khanka S, Singh Y, Prakash R, Rais N, Maurya AK, Gupta R, Mishra DK, Singh D, Kanojiya S. Bone fracture-healing properties and UPLC-MS analysis of an enriched flavonoid fraction from *Oxystelma esculentum*. Planta Medica. 2024 Feb;90(02):96-110.

17. Pandya DJ, Anand IS. Anti-ulcer potential of Oxystelma esculentum. International Journal of Green Pharmacy. 2011 Jan;5(1).

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