A Complete Review on *Oxystelma esculentum* R. Br.

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**ABSTRACT**

Many plants which are found commonly and are mentioned in texts of traditional Indian medicine have not been investigated thoroughly. It is necessary to conduct systematic evaluation, standardization, documentation and patenting of these plants. *Oxystelma esculentum* R. Br. (Family – Asclepiadaceae), commonly known as ‘Jaldudhi’, is one such plant which has not been studied sufficiently. It has many potential therapeutic uses which are of vital importance in curing the diseases of the modern world like cancer, hepatitis, kidney disorders, stress-related disorders and microbial infections. It contains two very important classes of phytoconstituents: cardenolides and pregnane glycosides, which are easily obtained from this plant and can act as precursors of many therapeutically important compounds. The study of this plant will be important in the future for bioactivity-guided fractionation of medicinal phytoconstituents, for conducting pre-clinical or clinical trials and for preparing formulations or semi-synthetic compounds. The present review, based on an extensive literature search of reputed books, scientific websites and high-impact journals, sheds light on the research done on this plant so far, thereby providing informative guidelines regarding the work that can be done in the future.

**Key words:** Asclepiadaceae, Cardenolides, Diuretic, Jaldudhi, *Oxystelma esculentum*, Pregnane glycosides

**INTRODUCTION**

*Oxystelma esculentum* R. Br. (Family – Asclepiadaceae), known as ‘Jaldudhi’, is a common Ayurvedic herb which has not been sufficiently explored. It is one of the few plants to contain cardenolides and pregnane glycosides, which are major classes of therapeutically important phytoconstituents. *O. esculentum* has been reported to possess good therapeutic action against many ailments of the current world. The present review, based on an extensive literature search of reputed books, websites and journals, remarks on the study done on this plant so far, thereby providing a direction for future research.

**Synonyms**


**Vernacular names[²]**

<table>
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<tr>
<th>Language</th>
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<tbody>
<tr>
<td>Sanskrit</td>
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<td>Dudhlata</td>
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<tr>
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<td>Khirai, Dudhialata</td>
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<td>Dudipala</td>
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<td>Tamil</td>
<td>Usipallai</td>
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**Distribution[²]**

Throughout plains and lower elevation areas of India, usually near water. Also found in Pakistan, Sri Lanka, Burma and extends to China and Indonesia.

**Taxonomic classification[³]**

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<th>Category</th>
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<td>Phanerogams</td>
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<td>SUBDIVISION</td>
<td>Angiosperms</td>
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DESCRIPTION OF THE PLANT

The plant genus derives its name from two words: Oxys (sharp) and Stelma (crown), which describes the acute lobes of the corolla. It is a twining herb or undershrub whose stem is cylindrical, glabrous, long, slender and much branched. Leaf is simple, opposite, dorsiventral, deciduous, usually 8 cm x 0.5 cm, linear lanceolate with acute apex and symmetrical base, having long and slender petiole. Inflorescence is racemose, subumbellate cyme or solitary. Flowers are widely open, white with purple veins, 2.5 - 3 cm in diameter, drooping, pedunculate, lateral subumbellate or racemose flowered cymes. Calyx is pentasepalous, connate, glabrous, oblong-lanceolate, acute, glandular inside. Corolla is pentapetalous, connate, 2.5 cm wide, glabrous, saucer-shaped, broadly rotate, lobed half-way down, having a densely pubescent corolline corolla, double corona. Corolla lobes are triangular, acute, ciliate, purple veined, valvate at base and shortly overlapping to the right. Androecium consists of five stamens, adnate near base of corolla, having connate filaments, anthers with inflexed membranous deltoid tips and waxy, pendulous, elongate-clavate, solitary pollen in each cell. Gynoecium is bicarpellary, with style apex truncate or convex, stigma depressed or sub-convex. Follicles are 4.5 - 7.5 cm long, often solitary, ovate-lanceolate, glabrous, having acute apex and containing numerous black, broadly ovate seeds [Fig. 1]. Other species of Oxystelma, which is rarely found in India, is Oxystelma var. wallichii. Its follicles are shorter, 2.5 - 4 cm long, oblong and rounded at both ends. The only morphological difference between the two varieties lies in its follicles.

USES

The plant has the property of being Ushna (hot), Guru (heavy), Ruksha (dry) and Katu (bitter). It is a diuretic, laxative, spermatogenetic, antitussive, anthelmintic and antileprotic. It increases Vattica and stimulates female fertility. Entire plant is used as diuretic, laxative, antiseptic, anthelmintic, antulcer, aphrodisiac, hepatoprotective and useful in leucoderma and bronchitis. Decoction of plant is used in ulcer, sore-throat and itches. Milky juice is used as galactagogue, antiperiodic, antulcer and as a vulnerary. Root is used ethnomedicinally in jaundice by the people of Orissa.

PHOTOCHROMICAL REVIEW

GENERAL CHEMICAL ANALYSIS

Researchers first carried out the chemical analysis of Oxystelma esculentum which revealed the presence of water, fibers, proteins, lipids and carbohydrates. Another pregnane glycoside Oxysine was isolated from the roots. Column chromatography of the chloroform extract using chloroform: methanol (24:1) as eluent afforded oxysine, a triglycoside of calogenin. A pregnane glycoside Esculentin was also isolated from the roots. Column chromatography of the methanolic
extract using chloroform: methanol (24:1) as eluent afforded esculetin, a triglycoside of sarcogenin. Researchers isolated polyhydroxypregnane glycosides Alpinosides A, B and C from the leaves of *O. esculentum*. Dried aerial parts were exhaustively extracted with ethanol: water (7:3) in a Soxhlet apparatus. The extract was concentrated under reduced pressure to a syrupy consistency. Crude extract was dissolved in methanol: water (2:1) and transferred into a separator funnel. The extract was shaken with hexane, chloroform and n-butanol respectively till exhaustion. The chloroform fraction was loaded on silica gel column. Fractions eluted with chloroform: methanol yielded three compounds of kidjolanin: Alpinoside A (pentaglycoside), Alpinoside B (tetraglycoside) and Apinoside C (pentaglycoside). The methanolic extract was found to inhibit the nitric oxide radical generated by PMS/NADH/NBT system. Moreover, the methanolic extract was found to scavenge the superoxide DPPH also increased in a dose dependent manner. The extract also decreased the body weight of the EAC-bearing mice. Hematological profiles indicated decrease in white blood cells, increase in red blood cells and increase in Hemoglobin content. The methanolic extract restored all the parameters of hematological profiles to normal. Treatment with methanolic extract decreased the levels of LPO and increased the levels of GSH, SOD and CAT. These data indicate that the methanolic extract of leaves of *O. esculentum* exhibits significant antitumor activity.

**Isolation of cardenolides**

Three cardenolides, Oxystelmine, Oxyline and Oxystelmoside, have so far been isolated from the roots of *O. esculentum*. Oxylene was found to be a tetraglycoside of 3-epi-uzarigenin, oxystelmoside is a diglycoside of uzarigenin whereas oxystelmine is a diglycoside of periplogenin.

**PHARMACOLOGICAL REVIEW**

**Diuretic activity**

Considering the claims in the traditional medicinal texts, researchers studied the effects of methanolic extract of leaves of *O. esculentum* on diuresis in male Wistar albino rats. Urinary output and excretion of electrolytes (Na⁺, K⁺, Ca²⁺ and Cl⁻) were measured. The methanolic extract significantly increased the urine output and had a significant effect on the electrolyte balance in a dose dependent manner, indicating that *O. esculentum* is an effective hypernatremic, hyperkalaemic, hypercalcemic and hyperchloremic diuretic.

**Antioxidant activity**

A group of researchers performed the evaluation of antioxidant and free radical scavenging activities of methanolic extracts of leaves of *O. esculentum* in various in vitro models. It was discovered that the total antioxidant activity increased with increasing concentration. The reducing capability and free radical scavenging activity in DPPH also increased in a dose dependent manner. The methanolic extract was found to scavenge the superoxide generated by PMS/NADH/NBT system. Moreover, the extract was found to inhibit the nitric oxide radical generated from sodium nitroprusside. The extract was also found to inhibit the hydroxyl radical generated by Fe³⁺/ascorbate/EDTA/water system. The extract scavenged the hydrogen peroxide in a dose dependent manner. These results give a clear indication that *O. esculentum* has a strong antioxidant activity and can be used as a natural antioxidant.

**Anticancer activity**

Antineoplastic activities of methanolic leaf extracts of *O. esculentum* on Swiss albino mice bearing Ehrlich’s ascites carcinoma were studied. Decrease in tumor volume, packed cell volume, and viable cell count were observed in methanolic extract-treated mice. The extract also decreased the body weight of the EAC-bearing mice. Hematological profiles indicated decrease in white blood cells, increase in red blood cells and increase in Hemoglobin content. The methanolic extract restored all the parameters of hematological profiles to normal. Treatment with methanolic extract decreased the levels of LPO and increased the levels of GSH, SOD and CAT. These data indicate that the methanolic extract of leaves of *O. esculentum* exhibits significant antitumor activity.

**Antimicrobial activity**

Antibacterial activity of leaves of *O. esculentum* against some hospital isolated human pathogenic bacterial strains was studied. From the results it is clear that leaves of *O. esculentum* are effective in controlling both gram positive and gram negative bacterial pathogens. The most effective crude extracts were ethyl acetate and methanolic fractions. Aqueous extract also showed sensitivity against all test organisms. Petrol and benzene extracts of the leaves showed weak antimicrobial action. Antimicrobial activity of methanolic extract of leaves *O. esculentum* was studied further. The antibacterial studies confirmed that the methanolic extract had a zone of inhibition, but the MIC in two fold serial dilution method ensured no prominent action on the tested bacterial strains. The antifungal studies confirmed that methanolic extract had an effective zone of inhibition against *C. albicans* and *C. neoformans*. In MIC studies, the methanolic extract had more effect on *C. albicans*, thus giving a lead for further in vivo antineoplastic studies. In future, the active constituent can be formulated into a topical dosage form.

**DISCUSSION**

*Oxystelma esculentum* is one of the few plants to contain cardenolides and pregnane glycosides, which can be obtained by simple and inexpensive methods from this plant. Also, these phytoconstituents can act as precursors of many other therapeutically important compounds. Due to the changing climate and lifestyle, health disorders like cancer, hepatitis, stress-related disorders, urinary disorders and bacterial infections have emerged as serious global issues. This plant has been reported to possess good therapeutic action against
many of such diseases. The present review can pave a way for a thorough evaluation, standardization, documentation and patenting of this plant. An exhaustive pharmacognostical, phytochemical, pre-clinical, clinical and formulation-based research on this plant can prove to be very fruitful for mankind.

REFERENCES