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# REVIEW ARTICLE

## UNVEILING THE BIOACTIVE COMPOUNDS AND THERAPEUTIC POTENTIAL OF SCIRPUS KYSOOR ROXB: A REVIEW AND FUTURE OUTLOOK

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**ABSTRACT**

*Scirpus kysoor Roxb* is a medicinal plant belonging to the family Cyperaceae and is traditionally used in Ayurveda for various medicinal purposes. The plant has been traditionally used for the treatment of various diseases, and scientific studies have confirmed its analgesic, antipyretic, antioxidant, and antimicrobial properties. This review was designed to highlight the complete information of plant including chemical constituents, pharmacological action, and pharmacokinetics. This information highlights the potential of the plant as a valuable source for the development of new therapeutics for human diseases.



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# INTRODUCTION

India has a rich intellectual and textual heritage that dates back to several hundreds of years. India stands out for having the world's greatest manuscript collections of any civilization. There are more than five million manuscripts collected, which consist of several valuable medical texts (Kundailia *et al.,* 2016). Ayurveda, the Indian indigenous system of medicine, dating back to the Vedic period (ca 4500-1600 BC) has been an integral part of Indian culture (Rajashree *et al*., 2014). Plants have been used as a rich source of effective and safe medicines for treatment of diseases due to their natural healing properties which are present in their phytochemicals' (Ajay Kumar Meena *et al*., 2010, Ajay Kumar Meena *et al*., 2009, Wungsem Rungsung *et al*., 2013, Umadevi *et al*., 2013). Phytochemicals, often known as phytonutrients, are non-essential chemical compounds found naturally in plants. They can be found in vegetables, grains, legumes, beans, fruits, herbs, nuts, roots, leaves and seeds. Plants get their color, flavor, and scent from substances called phytochemicals. These compounds are thought to be largely responsible for the medicinal properties and health benefits of medicinal herbs by boosting of immune system, Block substances we eat, drink and breathe from becoming toxic, reduce the inflammation, prevent DNA damage, help with DNA repair, reduce the kind of oxidative damage to cells, slowdown the growth rate of cancer cells, cause damaged cells to self-destruct so they can't divide or function as hormone regulators. Hence, Medicinal plants have been always chosen as an important source for the discovery of new therapeutics for human diseases. According to WHO estimate, about 80% of the world populations depend on traditional medicines, mostly on plant drugs to treat various ailments (Ajay Kumar Meena *et al*., 2010, Ajay Kumar Meena *et al*., 2009, Wungsem Rungsung *et al*., 2013, Shashi Alok *et al*., 2010). The oldest known type of medicine is herbal medicine. It was the mainstay of many early civilizations and still the most widely practiced form of medicine in the world today the developed countries, in the USA, for example, 25% of all prescriptions dispensed from community pharmacies from 1959 to 1980 contained plant extracts or active principles prepared from higher plants (Fransworth *et al*., 1985).

In Plant based products are most important sources for both food and medicinal purpose. In the past many years, the varieties of consumed crops are increasing globally, with many endemic varieties and crops species being collected from the wild for human nutrition and medicinal uses. This increase is based on traditional knowledge of indigenous peoples who used different plant parts including leaves, stem, tuber, bark, thorns, roots, fruits, young shoots, latex, and flowers for medicinal purposes (Yao, *et al*.,2018) Plants are the source of inspiration for novel drug combinations, as drugs derived from plants have made significant contributions to human health and well-being. The first generation of plant drugs were usually simple botanicals employed more or less in their crude form. The second generation of plant-based drugs emerged as the isolation of active phytoconstituents from plant extract using a scientific processing method (Iwu, *et al*.,2018). The practice of traditional medication has continued as most reasonable and effortlessly accessible primary sources of treatment for the human since the prehistoric time in the effective management of disease and others various ailments (Hosseinzadeh *et al*.,2015, Manivel *et al*.,2015, Madhumitha *et al*.,2016., Roopan *et al*.,2015). More than ten thousand phytocomponents have been identified by researchers, including Phytosterols, saponins, alkaloids, flavonoids, glucosinolates, polyphenols, terpenes, lectins, etc (Zhang *et al*.,2015). Naturally occurring phytochemicals can be broadly categorized as primary metabolites or secondary metabolites based on the biological requirements in plants. The primary metabolic process in plants produces primary metabolites like carbohydrates, fats, amino acid and nucleic acid (Weinberg *et al*.,1971). These metabolites are primarily important for the indispensable biological functions in plants which include the growth, development, and reproduction of plant cell. The secondary metabolites are very specific and found great in numbers among the several groups of plants. A key tool used by taxonomists to categorize plant species is the unique chemical features produced by the complex combination of secondary metabolites found in plants (Waterman *et al*.,1992). Many previous reviews revealed the wide range of the pharmacological and therapeutic effects of medicinal plants (Al-Snafi AE *et al*.,2016., Al-Snafi AE *et al*.,2016). This review was designed to highlight the complete information of plant including chemical constituents, pharmacological action of *Scirpus kysoor.*

## TAXONOMICAL CLASSIFICATION

**Rhizome of *Scripus kysoor***

**Shrub of *Scripus kysoor***

***Whole plant of Scripus kysoor***

***Scripus kysoor Roxb***

**Kingdom:** Plantae
**Phylum**: Tracheophyta
**Class**: Liliopsida
**Order**: Poales
**Family**: Cyperaceae
**Subfamily**: Cyperoideae

**Genus**: *Actinoscirpus (Ohwi) R.W.Haines & Lye*

**Species**: *Actinoscirpus grossus (L.f.) Goetgh. & D. A. Simpson, Scripus kysoor Roxb,*

**Synonym**: *S. grossus Linn F, Actinoscirpus grossus var kysoor, Rhynchospora kysoor Roxb, Scirpus grossus f kysoor Roxb, Scirpus grossus var kysoor Roxb.*

**Vernacular names**

**Ayurvedic**: Kasheru, Kasheruka.
**Sanskrit**: Kaseruka

**Assamese**: Kaheru
**Bengali**: Keshura
**English**: Water chestnut
**Gujarat**: Kasela, Kasola
**Hindi**: Kaseru
**Kannada**: Kasure gadd, Kaseruva, Kothigadde
**Kashmiri**: Kath
**Malayalam**: Kazhi Muthanga
**Marathi**: Kasara, Kachera, Kachora
**Oriya**: Kasaru Kawda, Kasaru Kanda
**Punjabi**: Kaseru
**Tamil**: Gundatigagaddi
**Telugu**: Guntatungagaddi
**Urdu**: Kaseru
**Siddha:** Karundan
**Tamil:** Gundatigagaddi
**Folk**: Kaseru (The Ayurvedic Pharmacopoeia of India Part I *et al.*,1999, Khare CP *et al.*,1999).

## BOTANICAL DESCRIPTION

### Macroscopic

**Rhizomes:** oval to cylindrical often branched having a number of transverse rings, black colored roots and rounded scars, black externally and cream colored internally, odour, aromatic, taste, bitter.

**Leaves:** Several to each stem and about as long as the stems 1 cm to 2 cm. wide linear, acuminate, the margin and keel somewhat hispid when young.

**Stem:** 100 to 150 cm height, 2-3 cm thick, triquetrous with concave sides and smooth angles, acuminate, coriaceous with smooth or scaberulous margins, sheaths long and open.

**Fruits:** 1.8 to 2.0 cm by 0.9 to 1 cm obovoid, broadest at the shoulders, tapering towards the base, angles subacute, sides sub-equal, plain or slightly convex. General surface, dark yellow to reddish brown, bearing longitudinal striations of fine ridges alternating with very five farrows, basal surface usually covered with glossy tomentum.

**Tuberous roots:** Tuberous roots are about the size of nutmeg, varying in diameter of 1.2-2 cm to 1.6-2.4 cm in length, cylindrical, oblong, knotty and tough in dry as well as in fresh condition. Colour black to brown, covered with erect straight or matted hairs much longer along with fibrous and stoloniferous adventitious roots.

**Microscopic:** Transverse section of rhizome shows epidermis of collapsed and brown colored cells: hypodermis, 4-8 cells with thick brown cell walls, followed by a wide zone of cortical ground tissue of oval to rounded, thin-walled, parenchymatous cells, filled with oval to spherical starch grains, encircled by sclerenchymatous sheath, vascular bundles, found scattered throughout cortical ground tissue, endodermis consists of brown colored cells with heavy thickenings on their walls, enclosing a wide central stellar ground tissue with a number of scattered vascular bundles of closed, collateral type, encircled by sclerenchymatous sheath, stellar ground tissues of rounded to oval, thin walled and parenchymatous cells, containing oval to spherical starch grains, a number of secretory cell with orange-brown contents found throughout cortical and stellar ground tissue.

**Powder**: Light brown, under microscope shows abundant round to oval starch grains and orange-yellow pigments, fragments of xylem vessels with annular thickenings and thin walled, parenchymatous tissue (The Ayurvedic Pharmacopoeia of India Part I et al., 1999)

## GEOGRAPHICAL DISTRIBUTION

*Scirpus kysoor*, a large perennial glabrous herb or an erect, robust, perennial herb. occurs often abundantly in swampy or inundated locations, pools, ditches, especially along coastal areas on the margins of the tanksy river beds and rice fields from sea level up to 700m altitude of Bangladesh, Nepal, India, Bengal, Bihar, Madras, Maharashtra, Southeast Asian Countries, Australia, Borneo, Bhutan, Cambodia, China, Indochina, Indonesia, Laos, Malaysia, Myanmar, Pakistan, Sri Lanka, Thailand and Vietnam (The Ayurvedic Pharmacopoeia of India Part I et al.,1999, Khare CP et al.,1999).

## CHEMICAL COMPOSITION

The tuber gave progesterone, sugars, tannins, starch and saponins. The fruit contains amylase, The aromatic compounds isolated from the rhizomes include derivatives of benzaldehyde, hydroxybenzoic and cinnamic acids (Khare CP *et al.*,1999, Lerdluksamee *et al.,2013*). Ethanolic extract of coarse powder of tuber yielded carbohydrate, coumarins, flavonoids, steroid, tannin and terpenoid (Ganapathi *et al.*,2017). Methanolic extract of root yielded flavonoids, alkaloids and tannins (Subedi NK *et al.*, 2016).

## IDENTITY, PURITY AND STRENGTH

Foreign matter: Not more than 2 per cent**,** Total Ash: Not more than 8 per cent**,** Acid-insoluble ash: Not more than 3 per cent**,** Alcohol-soluble extractive: Not less than 4 per cent**,** Water-soluble extractive: Not less than 9 per cent (The Ayurvedic Pharmacopoeia of India Part I et al.,1999).

## TRADITIONAL USES

Tuber is used as nutritious, astringent, antidiarrheal, antiemetic, galactagogue, hypoglycaemic, diuretic, urinary antiseptic, dysuria, genitourinary affections, dyscrasia, spermopoietic, liver tonic against infection, burning sensation, fever and gonorrhea. In Ayurveda used for treatment of scanty micturition, jaundice, weakness of cardiac muscles and low sperm count. The Ayurvedic Pharmacopoeia of India recommends the powder of the rhizome for promoting spermatogenesis and development of breast development of breast (Khare CP *et al.*, 1999). The sap extracted from leaves and stem of is mixed with garlic paste applied topically for cattle wounds (Mishra *et al.*, 2010)

## PHARMACOLOGICAL ACTIONS

**Analgesic and antipyretic activity:** The study's goal is to evaluate the analgesic and antipyretic properties of the methanol extract and its various fractions from the root of *Schoenoplectus grossus* using acetic acid-induced writhing and radiant heat tail flick pain models in mice, as well as yeast-induced pyrexia in rats, at doses of 400 and 200 mg/kg. In the acetic acid writhing test, the methanol extract, petroleum ether, and carbon tetrachloride fractions showed considerable ($5<0.001$ and $5<0.05$) suppression of writhing responses in a dose-dependent manner. This effect was dose dependent. The methanol extract at 400 and 200 mg/kg being more protective with 54% and 45.45% of inhibition compared to diclofenac sodium of 56% followed by petroleum ether fractions of 49.69% and 39.39% at the same doses. The extracts did not produce any significant antinociceptive activity in tail flick test except standard morphine. When studied on yeast induced pyrexia, methanol and petroleum ether fractions significantly lowered the rectal temperature time dependently in a manner similar to standard drug paracetamol and distinctly more significant (5<0.001) after second hour. These findings suggest that the root extracts of S. grossus possess significant peripherally acting analgesic potential and antipyretic property. The phytochemicals screening showed the presence of flavonoids, alkaloids, and tannins (Subedi NK *et al*.,2016).

**Antioxidant activity:** Traditional medicine frequently employs a variety of plant extracts or bioactive ingredients. Traditional herbal practitioners have discovered the therapeutic usefulness of several indigenous plants for a variety of ailments. Synthetic and traditional herbal medication are both obtained from natural sources. *Actinoscirpus grossus var. Kysoor (Robx.) Nolite* is an herbaceous plant from the Cyperaceae family that is used in Ayurveda to cure a variety of ailments. In this study, leaf portions of *Actinoscirpus grossus var. kysoor (Robx.) Nolite* were evaluated for phytocomponents and free radical scavenging capacity using both qualitative and quantitative methods. The cold maceration method was used to prepare methanol and chloroform extract. Preliminary phytochemical screening found that methanolic leaf extract outperformed chloroform in terms of the presence of alkaloids, carbohydrates, phenols, flavonoids, terpenoids, and steroids, while saponins and glycosides were lacking. Detailed quantitative investigation revealed total phenol and flavonoid content of 172.17 ± 0.33 mg GAE/g and 26.66 ± 4.409 mg QE/g, respectively. The findings point to an abundance of phenolic and flavonoid components in plants. Anti-oxidant activity was carried out using DPPH radical scavenging assay for the methanolic leaf extract. 50% inhibition concentration value of methanolic leaf extract was found to be 144.01 ± 0.33 µg/mL, which was very nearer to the positive control i.e., 133.63 ± 0.41 µg/mL. The results indicated significant antioxidant potential. The plant has been demonstrated to be a good source for manufacturing medications from its extracts, which can be very advantageous for advancement in medicine, and its future investigation could make it pharmaceutically essential (Bhati *et al*.).

**Antimicrobial activity**

**Objective:** The current study sought to determine the antibacterial activity of matured and unripened fruits of *Anthocephalus cadamba* and *Scripus kysoor Roxb* tuber against food pathogens. Methods: Different solvent extracts of *Anthocephalus cadamba* fruits and *Scirpus kysoor Roxb* tubers were tested for antimicrobial activity against Gram-negative and Gram-positive bacterial cultures using the agar well diffusion method, as well as the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC). MIC was determined using the broth micro dilution technique. The results show that all plant materials have antibacterial action. Among all plant materials, the macerated ethyl acetate extract of *Scirpus kysoor Roxb* tuber had the lowest MIC against Bacillus Cereus (0.312 mg/ml). Macerated ethanol extract was shown to be more potent in ripened *Anthocephalus cadamba* fruits, while macerated ethyl acetate extract was found to be more active in unripened *Anthocephalus cadamba* fruits based on MIC. Conclusion: This investigation revealed that all the plant materials possess high antibacterial activity against food pathogens, and hence may be exploited as a source of safe herbal antimicrobial agent (Datar *et al*.,2016).

**Hepatoprotective activity:** The liver detoxifies the bulk of pollutants and is essential for maintaining the body's balance. The incidence of liver toxicities has risen in recent years as a result of excessive drug and alcohol consumption. *Actinoscirpus grossus* tubers are used as a liver tonic in folklore medicine; however there is no experimental data to back up their therapeutic value. As a result, the current investigation was carried out to assess the hepatoprotective properties of an ethanolic extract of *Actinoscirpus grossus* tubers in albino rats subjected to ethanol-induced hepatotoxicity. Daily treatment with 20% ethanol v/v p.o. at a dose of 5 g/kg for 30 days resulted in significant liver damage, which was then sustained for 15 days with normal rat pellet and water ad libitum. After 30 days of ethanol administration, the treatment groups received group-specific medications for 15 days in a row, while the control group rats were fed standard rat pellets and water ad libitum for 15 days. On the 45th day, liver damage was measured using biochemical, histology, and antioxidant levels. Daily dosing of 20% ethanol significantly elevated liver enzymes and produced oxidative stress in liver homogenate, as lipid peroxidation rose and catalase and glutathione peroxidase activity decreased. Histopathological examination revealed micro and macro vesicular fatty alterations, mostly with minor periportal inflammation, cell infiltrate, and areas of mild sinusoidal dilatation with ballooning hepatocyte degeneration. The ethanolic extract of *A. grossus* tuber dramatically restored liver functions, particularly SGOT, and reduced increased lipid peroxidation while restoring catalase and glutathione peroxidase activity. Histopathological analysis demonstrated a considerable reduction in hepatocyte ballooning portal fibrosis. Thus, tubers of the *A. Grossus* plant may serve as a storehouse of natural chemicals with various functions and could be employed as an efficient hepatoprotective agent (Ganapati *et al*., 2021).

**Phytotoxicity study:** A phytotoxicity study was carried out to assess the maximal accumulation of Fe and Al in *Scirpus grossus*, as well as to isolate and identify Fe-Al-resistant rhizobacteria from its roots. Plants were grown in artificial bauxite mining wastewater containing iron (Fe) and aluminum (Al) (at a mass ratio of 3:1) with five different Fe-Al mixture concentrations (ranging from 90 mg/L Fe + 30 mg/L Al to 450 mg/L Fe + 150 mg/L Al) for 102 days, along with a plant control (without the addition of Fe and Al). On day 42 of the 450 mg/L Fe + 150 mg/L Al treatment, plants accumulated the most metal (53,187 mg Fe/kg and 8,864 mg Al/kg on a dry basis). On day 102, approximately 27 rhizobacteria were recovered from roots across all treatments. Among these, three isolates, Bacillus cereus strain NII, Bacillus pumilus strain NII, and Brevibacterium sp. Strain NII demonstrated high resistance and tolerance to the medium's maximum Fe-Al concentrations (450 mg/L Fe and 150 mg/L Al). Thus, they can be classed as Fe-Al-resistant rhizobacteria, since they survived and tolerated the most in Fe- and Al-rich conditions during screening (Nur 'Izzati Ismail *et al*.,2017).

# CONCLUSION

The text gives a detailed account of the medicinal plant *Scirpus kysoor*, including its taxonomy, botanical description, geographical distribution, chemical composition, identification, purity, strength, traditional usage, and pharmacological activities. The plant has long been utilized in Ayurveda for a variety of medical uses, and modern research have proven its analgesic, antipyretic, antioxidant, and antibacterial qualities. This report emphasizes *Scripus kysoor's* potential as a valuable source for the development of new human illness therapies.

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