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Pharmacognostic studies of *Spermadictyon suaveolens* Roxb. and their traditional ethnomedicinal utilization: A review

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ABSTRACT

Background & Aim: The current study was performed to evaluate the ethnobotanical uses, chemical constituents of *Spermadictyon suaveolens* Roxb. and their pharmacological activities through literature search. Owing to its traditional medicinal uses, its preliminary phyto-evaluation has resulted in various bioactive compounds, which have been shown to have antimicrobial and antiviral potential.
Experimental: We conducted a survey in diverse databases (such as Google scholar, Scopus, and Web of Science, etc.) and professional websites with a key word related to our study. Firstly, we evaluated the traditional utilization of *Spermadictyon suaveolens* Roxb. and then the pharmacological studies.
Results: *Spermadictyon suaveolens* are traditionally utilized by tribes to treat bone pain, wound healing, diabetes, snake bites, scorpion stings, viral infection, and for making gunpowder charcoal. The leaves, flowers, and stems of *Spermadictyon suaveolens* have been investigated for various chemical compounds with pharmacological activities, such as antifungal, antimicrobial, antimalarial, antioxidant, anticancer, anti-inflammatory, anti-diuretic, and insecticidal activities. The root and bark are not well explored for chemical constituents and pharmacological activities.
Recommended applications/industries: *Spermadictyon suaveolens* Roxb need to be subjected to scientific verification based on their traditional utilization, which may lead to a better and effective alternative phytoconstituents for the management of various diseases.

1. Introduction

Plants have been the primary source of therapeutic agents for curing human diseases for a long time. Drugs from natural resources are essential for the prevention of any diseases since medicinal plants have been traditionally practiced for veterinary diseases (Shoaib *et al.*, 2021) and human diseases in different areas (Shah *et al.*, 2021). In this way, pharmacognosy plays a vital role in the discovery, characterization, and production of these drugs (Cahlíkova *et al.*, 2020). A positive development is recorded with the increased use of herbal remedies worldwide (Jones *et al.*, 2006). The pharmacognostic study will help to discover drugs and is the best approach to molecular and genetic discoveries (Alamgir, 2018; Harvey, 2000). Besides, more than half of the modern drugs have been originated from traditionally used plants (Abbasi *et al.*, 2010). There is an urgent need to document the ethnomedicinal uses of plants worldwide and collaborate with chemists to analyze the compounds in medicinal plants. Such information needs verification through *in vitro* and *in vivo* scientific investigationand clinical trials in order to ascertain and establish their utility.

Phytochemicals are responsible for the medicinal activity of plant species. They can cure various ailments and possess potential anti-inflammatory, anti-bacterial, analgesic, diuretic, anti-oxidant and anti-fungal properties. Natural products from medicinal plants, either as pure compounds or as extracted, provide opportunities for new drugs because of the unmatched availability of chemical diversity and are not as costly as their chemical counterparts (Nirumand *et al.*, 2018). Due to the rising demand for chemical diversity in screening programs, seeking therapeutic drugs from herbal products is quite interesting worldwide. Botanicals and herbal preparations for medicinal purposes contain various bioactive compounds like flavonoids, alkaloids, saponins, sterols, etc.

A medicinal plant shrub species *Spermadictyon suaveolens* Roxb. (*S. suaveolens*)(Fig.1) belongs to the family Rubiaceae, found in the Indomalayan region and China (Govil *et al.*1993) as well as Northern areas of Pakistan (Perveen and Qaiser, 2007), and it grows up to 12 ft. Also, it can be cultivated in the garden for ornamentals purposes. It has been practiced by ancient medical systems for the treatment of the dermatological disorder (cuts, wounds, boils, foot cracks, burns) and gastrointestinal disorders (stomachache, colic, vomiting, cholera, digestion, dysentery, constipation) (Singh *et al.*, 2014). The leaves of *S. suaveolens* are found to be more effective against wounds, cholera, and diarrhea (Gaur, 1999; Pande *et al.*, 2006). A very few literary works are available in search of "pharmacognosy of *S. suaveolens"* such as Kavita *et al.* (2016) who investigated the phytochemical characteristics and antioxidant activity of the stem of this plant. Further chemical evaluation of the plant parts is required to document their efficiency and better utilization.

Fig. 1. The inflorescence of *Spermacictyon suaveolens (*Kavita *et al.*, 2016).

2. Survey methodology

The data presented in this review paper were obtained from diverse databases and professional websites. We conducted a survey in the Google scholar, Web of Science, Science Direct, PubMed, CAB abstracts, Springer, Taylor, and Francis using different keywords including *S. suaveolens*, Pharmacognosy, medicinal plant, phytoconstituents, traditional knowledge, herbal remedies, ethnomedicinal uses, anti-microbial, anti-fungal, and bioactive compounds to obtain relevant information regarding pharmacognostic studies of *S. suaveolens* and its ethnomedicinal uses.

3. Microscopic evaluation of *Spermacictyon sueveolens*

Microscopic features is considered useful for the herbal drugs and their quality study, such as qualitative microscopy of root, bark, and leaf transverse section (T.S) with or without staining under photomicrograph (Alamgir, 2018). Microscopic features of the transverse section of the *S. suaveolens* stem, leaf and anomocytic type of stomata are shown in (Fig. 2). The species of the family Rubiaceae has mostly paracytic stomata in leaves (Bahadur *et al.*, 1971).

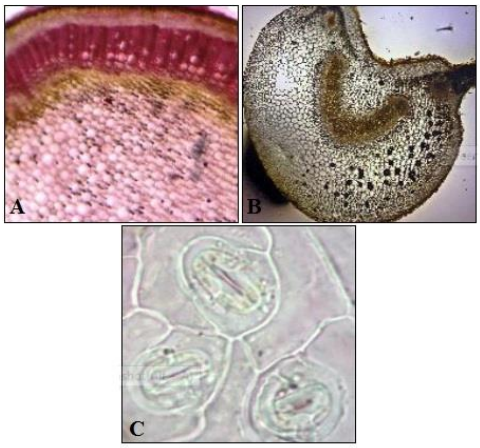

Fig. 2. Microscopic features of the transverse section of *S. suaveolens* stem (A), leaf (B) and stomata structure (C) (Kavita *et al.*, 2016).

4. Traditional utilization and chemical constituents

The stem and leaves of *S. suaveolens* were traditionally used to treat various ailments. The well-known traditional utilization of root and stem is usually

for herpes, bone pain, wound healing and diabetes (Kavita *et al.*, 2016). Stem powder has been used against viral infections. It has been practiced by the tribal of Rajasthan (India) against snake bites, scorpion stings, and diabetes (Govil *et al.*, 1993). The wood is reported to be used to make gunpowder charcoal (Ravishankar and Shukla, 2007) and leaves as an insecticide for the stored grains (Gaur, 1999). The root paste is used externally for joint pain traditionally (Pradhan and Badola, 2008). The stem, leaves, and flowers of *S. suaveolens* have been investigated for phytochemicals and various pharmacological activities. The traditional utilization of its parts for specific disease may be due to the bioactive chemical constituents present inside the plant parts.

Previous studies demonstrated that the stem, flower, and leaves of *S. suaveolens* are rich in alkaloids, flavonoids, tannins, phenolics, carboxylic acids, amides, carbohydrates, and saponins (Table 1)(Govindappa *et al.*, 2014; Kavita *et al.*, 2016; Silva *et al.*, 2014). However, no clear evidence is available on chemical constituents and pharmacological activity of their bark and roots. The traditional knowledge of *S. suaveolens* should be considered for further clinical trials of the chemical constituents, especially on roots and bark, to investigate their efficiency and better utilization.

Table 1. Pharmacological activity and chemical constituents of *Spermadictyon suaveolens***.**

Plant part	Pharmacological activities	Chemical/functional groups	Chemical constituents/ extract	References
Stem	Antioxidant	Alkaloid, saponin flavonoid, tannin, (fats, starch, tannin, red. sugar, protein)	Tritetraconatne, ergost-5-en-3-ol, n-hexadecanoic acid, 2-methoxy-4 (1-propynyl), 22, 23-dimethyl-, acetate (3 β) and ß sitosterol, stigmasterol, azulene, tetratetracontane, 9-nonadecane	(Kavita *et al.*, 2016; Kulkarni and Sathe, 2013)
Leaves	Antifungal, antimicrobial, antimalarial, antioxidant, anticancer, anti-inflammatory, anti-diuretic, insecticidal	Carbohydrates, alkaloids, flavonoids, phenolics, tannins, saponins, terpenoids, aromatic, amines, amides, carboxylic acids, alkanes	Cyclobutanol, 4-acetoxy-3-methoxy styrene, cyclohexane, decyl, 1-pentadecene, palmitaldehyde (Di iso penty lacteal), benzene ethanamine, 3,4-benzyloxy-2,5-difluoro-. beta. -hydroxy-n-me, 1-octadecene, ethanone, 1-(3-methylene cyclo pentyl)	(Dahpour *et al.*, 2012; Ertas *et al.*, 2015; Gaur, 1999; Govindappa *et al.*, 2014; Igwe and Okwu, 2013; Nakamura *et al.*, 1986; Papitha *et al.*, 2017; Sathyaprabha *et al.*, 2010)
Flowers	Analgesic, anti-inflammatory, antipyretic, antiviral, antimicrobial	Aromatic, unsaturated aldehydes, ketones, aliphatic amines, amines, amides, carbohydrates, alkaloids, flavonoids, phenolics, tannins, saponins, terpenoids	Adamantine, methylamine, alpha.-methyl, 3,7,11,15-tetramethyl-2-hexadecen-1-ol, 1-octadecyne, phytol, phosphine, triphenyl, 1,6;3,4-dianhydro-2-deoxy- beta-d-lyxo-hexopyranose, paredrine TMS, cyclotrisiloxane, hexamethyl	(Al-Wathnani *et al.*, 2012; Papitha *et al.*, 2017; Silva *et al.*, 2014; Tsunoda *et al.*, 1965; Zhu *et al.*, 2011)
Bark	Anti-inflammatory, hepatoprotective	Not well explored	Ethanolic extract, methanol extract	(Balasubramanian *et al.*, 2010)

5. Pharmacological activities of chemical constituents

The major chemical groups found in *S. suaveolens* are alkaloids, saponins, flavonoids, tannins, phenolics, etc., containing various types of bioactive compounds (Table 1). Chemical constituents of *S. suaveolens* have been investigated by GC-MS analysis using either different or single extraction methods (petroleum ether, chloroform, ethyl acetate, and methanol). Antiviral activity were attributed to compounds such as adamantine methylamine, alpha-methyl (Coates, 2006). Tetramethyl-2-hexadecen showed anti-inflammatory, analgesic and antipyretic activities (Tsunoda *et al.*, 1965). Octadecyn and phytol were reported to have anti-bacterial (Zhu *et al.*, 2011) and anti-inflammatory (Dangoggo *et al.*, 2012) activities, respectively. Cyclotrisiloxane, and hexamethyl was reported to possess anti-bacterial activity (Al-Wathnani *et al.*, 2012) and phenol showed anti-fungal, anti-microbial, antimalarial, UV-stabilizer and anti-oxidant properties for hydrocarbon-based products (Dahpour *et al.*, 2012). Tetramethyl-2 hexadecen-1-ol showed anti-microbial,

anticancer, anti-inflammatory, and anti-diuretic activities (Govindappa *et al.*, 2014). Pentatriacontene is a herbistat (Sadananda *et al.*, 2014), and Octadecane is known to have anti-fungal activity (Abubacker and Devi, 2015). Hexadecanoic acid, benzenedicarboxylic acid, ethylhexyl ester, and sistosterol was reported to have anti-bacterial activities (Sathyaprabha *et al.*, 2010; Yinusa *et al.*, 2015).

6. Conclusion

In summary, the traditional utilization of stem and the chemical constituents of flowers from *S. suaveolens* has shown good efficacy against viral infections, demonstrating that the plant has the great potential against viral diseases and considering the present COVID-19 pandemic, which is a serious threat to human life, this potential could be very important. Further clinical trials are required regarding the efficacy and safety of *S. suaveolens* against viral infection, and other pharmacological activities need to be subjected to scientific verification, which may lead to finding a better and effective alternative phytoconstituents for the treatment of COVID-19 and other several diseases. Pharmacognostic studies of their roots and bark are further recommended for future work.

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8. References

Abbasi, A., Khan, M., Mushtaq, A. and Muhammad, Z. 2010. Herbal medicines used to cure various ailments by the inhabitants of Abbottabad District, North West Frontier Province, pakistan. *Indian Journal of Traditional Knowledge*, 9(1):175-183.

Abubacker, M.N. and Devi, P.K. 2015. In vitro antifungal potentials of bioactive compounds heptadecane, 9-hexyl and ethyl iso-allocholate isolated from *Lepidagathis cristata* willd. (acanthaceae) leaf. *British Biomedical Bulletin*, 3:336-343.

Al-Wathnani, H., Ara, I., Tahmaz, R., Al-Dayel, T. and Bakir, M. 2012. Bioactivity of natural compounds isolated from cyanobacteria and green algae against human pathogenic bacteria and yeast. *Journal of Medicinal Plants Research*, 6(18): 3425-3433.

Alamgir, A. 2018. Molecular pharmacognosy-a new borderline discipline between molecular biology and pharmacognosy *Therapeutic use of medicinal plants and their extracts:* Vol 2. Springer, pp. 665-720.

Bahadur, B., Rajagopal, T. and Ramayya, N. 1971. Studies on the structural and developmental variation and distribution of stomata in the rubiaceae. *Botanical Journal of the Linnean Society*, 64: 295-310.

Balasubramanian, T., Chatterjee, T.K., Sarkar, M. and Meena, S.L. 2010. Anti-inflammatory effect of *Stereospermum suaveolens* ethanol extract in rats. *Pharmaceutical Biology*, 48(3): 318-323.

Cahlíkova, L., Safratova, M., Hostalkova, A., Chlebek, J., Hulcova, D., Breiterova, K. and Opletal, L. 2020. Pharmacognosy and its role in the system of profile disciplines in pharmacy. *Natural Product Communications*, 15:1934578X20945450.

Coates, J. 2006. Interpretation of infrared spectra, a practical approach. Encyclopedia of analytical chemistry: applications, theory and instrumentation, Newtown, USA.

Dahpour, A.A., Rahdari, P. and Sobati, Z. 2012. Chemical composition of essential oil, antibacterial activity and Brine shrimp lethality of ethanol extracts from *Sedum pallidum*. *Journal of Medicinal Plants Research*, 6(16): 3105-3109.

Dangoggo, S., Hassan, L., Sadiq, I. and Manga, S. 2012. Phytochemical analysis and antibacterial screening of leaves of *Diospyros mespiliformis* and ziziphus spina-christi. *Journal of Chemical engineering*, 1(1): 31-37.

Ertas, A., Yilmaz, M.A. and Firat, M. 2015. Chemical profile by LC–MS/MS, GC/MSand antioxidant activities of the essential oils and crude extracts of two euphorbia species. *Natural Product Research*, 29(6): 529-534.

Gaur, R. 1999. Flora of the District Garhwal, North West Himalaya. 1st ed. TransMedia. Srinagar, Garhwal.

Govil, J., Singh, V. and Hashmi, S. 1993. Medicinal plants: New vistas of research/editor in chief, J. Ngovil; editors, V. Ksingh and sharmima hashmi. Glimpses in plant research; vol. 10. Today and *Tomorrow's Printers and Publishers*. New Delhi.

Govindappa, M., Prathap, S., Vinay, V. and Channabasava, R. 2014. Chemical composition of methanol extract of endophytic fungi, alternaria sp. of *Tebebuia argentea* and their antimicrobial and antioxidant activity. *International Journal of Biological and Pharmaceutical Research*, 5:861e869.

Harvey, A. 2000. Strategies for discovering drugs from previously unexplored natural products. *Drug Discovery Today*, 5(7): 294-300.

Igwe, O.U. and Okwu, D.E. 2013. GC-MS evaluation of bioactive compounds and antibacterial activity of the oil fraction from the seeds of *Brachystegia eurycoma* (Harms). *Asian Journal of Plant Science and Research*, 3(2): 47-54.

Jones, W.P., Chin, Y.W. and Kinghorn, A.D. 2006. The role of pharmacognosy in modern medicine and pharmacy. *Current Drug Targets*, 7(3): 247-264.

Kavita, M., Rakshe, A. and Mokat, D. 2016. Pharmacognostic studies of drug *Spermadictyon suaveolens* Roxb. *International Journal of Pharmacognosy*, 3(5): 234-239.

Kulkarni, M. and Sathe, P. 2013. Phytochemical and GC-MS analysis of *Hamiltonia suaveolens* (Roxb). *International Journal of ChemTech Research* CODEN, 5: 212-219.

Nakamura, K., Hatakeyama, T. and Hatakeyama, H. 1986. DSC studies on hydrogen bonding of poly (4-hydroxy-3, 5-dimethoxystyrene) and related derivatives. *Polymer journal*, 18: 219-225.

Nirumand, M.C., Hajialyani, M., Rahimi, R., Farzaei, M.H., Zingue, S., Nabavi, S.M. and Bishayee, A. 2018. Dietary plants for the prevention and management of kidney stones: Preclinical and clinical evidence and molecular mechanisms. *International journal of molecular sciences*, 19(3): 765.

Pande, P.C., Tiwari, L. and Pande, H. 2006. Folk-medicine and aromatic plants of uttaranchal: Bishen Singh Mahendra Pal Singh.

Papitha, R., Ravi, L. and Selvaraj, C.I. 2017. Phytochemical studies and GC-MS analysis of *Spermadictyon suaveolens* Roxb. *International Journal of Pharmacy and Pharmaceutical Sciences*, 9: 143-149.

Perveen, A. and Qaiser, M. 2007. Pollen flora of pakistan-Liv. Rubiaceae. *Pakistan Journal of Botany*, 39(4): 999-1015.

Pradhan, B.K. and Badola, H.K. 2008. Ethnomedicinal plant use by lepcha tribe of Dzongu valley, bordering *Khangchendzonga biosphere* reserve, in North Sikkim, India. *Journal of Ethnobiology and Ethnomedicine*, 4: 22.

Ravishankar, B. and Shukla, V. 2007. Indian systems of medicine: A brief profile. *African Journal of Traditional, Complementary and Alternative Medicines*, 4(3): 319-337.

Sadananda, T., Govindappa, M. and Ramachandra, Y. 2014. In vitro antioxidant activity of lectin from different endophytic fungi of *Viscum album* L. *Journal of Pharmaceutical Research International*, 4(5): 626-643.

Sathyaprabha, G., Kumaravel, S., Ruffina, D. and Praveenkumar, P. 2010. A comparative study on antioxidant, proximate analysis, antimicrobial activity and phytochemical analysis of Aloe vera and Cissus quadrangularis by GC-MS. *Journal of Pharmacy Research*, 3(12): 2970-2973.

Shah, G.M., Shad, N., Sajid, M., Asma, Naeem, A., Khan, F.U., Jabeen, N., Urooj, M., Muhammad, S. and Hasnain, M. 2021. Herbal remedies used for the management of urolithiasis in Abbottabad, Northern Pakistan. *Plant Science Today*, 8(4): 836-847.

Shoaib, G., Shah, G.-M., Shad, N., Dogan, Y., Siddique, Z., Shah, A.H., Farooq, M., Khan, K.R. and Nedelcheva, A. 2021. Traditional practices of the ethnoveterinary plants in the Kaghan Valley, Western Himalayas-Pakistan. *Revista de Biología Tropical*, 69(1): 1-11.

Silva, R.O., Sousa, F.B.M., Damasceno, S.R., Carvalho, N.S., Silva, V.G., Oliveira, F.R.M., Sousa, D.P., Aragão, K.S., Barbosa, A.L. and Freitas, R.M. 2014. Phytol, a diterpene alcohol, inhibits the inflammatory response by reducing cytokine production and oxidative stress. *Fundamental and Clinical Pharmacology*, 28(4): 455-464.

Singh, H., Husain, T., Agnihotri, P., Pande, P. and Khatoon, S. 2014. An ethnobotanical study of medicinal plants used in sacred groves of Kumaon Himalaya, Uttarakhand, India. *Journal of Ethnopharmacology*, 154(1): 98-108.

Tsunoda, A., Maassab, H., Cochran, K. and Eveland, W. 1965. Antiviral activity of alpha-methyl-1-adamantanemethylamine hydrochloride. *Antimicrobial Agents and Chemotherapy*, 5: 553-560.

Yinusa, I., George, N.I., Ayo, R. and Rufai, Y. 2015. Evaluation of the pharmacological activities of beta sitosterol isolated from the bark of *Sarcocephalus*

latifolius (smith bruce). *Global Journal of Pure and Applied Chemistry Research*, 3: 7-14.

Zhu, Z.Z., Ma, K.J., Ran, X., Zhang, H., Zheng, C.J., Han, T., Zhang, Q.Y. and Qin, L.P. 2011. Analgesic, anti-inflammatory and antipyretic activities of the petroleum ether fraction from the ethanol extract of *Desmodium podocarpum*. *Journal of Ethnopharmacology*, 133(3): 1126-1131.