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Senna alata (L.) Roxb. Ethnobotanical significance in Nepal

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Abstract

Senna alata (L.) Roxb.is a well-recognized medicinal plant valued across the globe for its therapeutic properties which have been extensively utilized in traditional and modern herbal remedies. In Nepal like many other regions this plant holds significant ethno pharmacological importance, yet comprehensive documentation of its indigenous uses remains limited. This study aims to explore and document the traditional knowledge, applications and cultural significance of S. alata among different communities in Nepal providing insights into its role in indigenous healthcare practices and potential for further pharmacological research.

The study was carried out in six districts of Nepal from March to November 2024. Semi-structured interviews were conducted in 6 districts involving 90 respondents.

This research result showed that the species is primarily used for medicinal purposes (74.1%), with smaller proportions allocated to food (13.31%) and rituals applications (12.5%). The uses of the species varied in different communities of Nepal. Decoction (75.56%), paste (35.56%) and cooked (12.22%) were the forms mainly used by the local population. The leaves (81.11%) were the most commonly used part of the plant. Flowers (25.56%), seed (20%), stem (7.78%) and root (2.22%) were used, but to a lesser extent. In addition, leaves and flowers were mainly used parts of the species to treat skin related diseases while seeds and roots were used for constipation and fever.

These results demonstrate the medicinal importance of S.alata in Nepal and suggest the need for priority actions for the sustainable management and use of the species. Further research on the medicinal components of different parts of the plant could aid its promotion and recognition.

Keywords Ethnobotany, Fabaceae, Human diseases, Traditional medicine

Background

The utilization of plant genetic resources for medicinal applications dates back to ancient times rooted in humanity's quest to preserve health (Angmo et al., 2024; Daskum et al., 2019). These resources are increasingly in demand worldwide for managing various ailments(Singh, 2020). In developing nations particularly among lower-income groups traditional medicine continues to serve as a key healthcare solution (Sánchez et al., 2020). This preference is driven by the plants bioactive compounds, their traditional ethnopharmacological uses and the high user satisfaction they generate, which is largely

due to their high total phenolic and flavonoid Content (TPC and TFC) (Lamichhane et al., 2014 ; Neupane et al., 2020). Moreover, the escalating costs and possible adverse effects of modern treatments further drive the dependence on traditional remedies (Pangeni et al., 2020; Rahman et al., 2021). Such remedies are commonly employed to address diseases like cancer, malaria, bacterial infections, and diabetes (Kunwar et al., 2022). If left untreated, some of these conditions may lead to additional health complications including sexual dysfunction(Parveen et al., 2020). Over time, the evolution of traditional knowledge, especially in rural communities has facilitated disease treatment using wild-harvested or cultivated plants selected for their healing properties (Amjad et al., 2020).

This shrub is highly valued for its medicinal properties, traditionally utilized by diverse indigenous groups globally for its therapeutic benefits.(Oladeji et al., 2020). Historically, it has been employed to remedy skin ailments, respiratory conditions and liver disorders. The leaves and flowers are processed in various ways by local populations to treat these diseases (Osunga et al., 2023). The flower of this plant is also used for rituals purposes (Sharma, 2020).

In Nepal, *Senna alata* is valued for its ecological benefits and medicinal properties. It aids in soil stabilization, supports pollinators by providing habitat and thrives in diverse climatic conditions due to its adaptability and rapid growth(Pathak & Baniya, 2017).

Different parts of *S. alata* exhibit medicinal properties including anti-hyperglycemic, anti-hyperlipidemic, antioxidative, anti-hepatotoxic, anti-inflammatory, antibacterial and antidiabetic effects (Karki et al., 2023; Onyegeme-Okerenta & Essien, 2021). Due to these therapeutic benefits the plant serves as an important resource for managing conditions such as diabetes, typhoid, malaria, and rheumatism (Jain, 2007).

Global research has extensively explored the medicinal applications and phytochemical composition of *Senna alata*, underscoring its therapeutic potential for diverse ailments. Recent studies on leaf, root and seed extracts have confirmed potent antibiotic properties reinforcing its role as a key resource for managing multiple health conditions (Daskum et al., 2019; Suriya et al., 2023). However, despite these pharmacological findings, the utilization of this species often varies significantly across local communities. Such differences arise from distinct cultural interactions with local ecosystems and reliance on natural resources (Amjad et al., 2020).

This research represents the ethnobotanical study on *Senna alata* in Nepal, a species widely recognized for its significant medicinal properties. Although the plant is extensively used in traditional medicine there are currently no structured conservation measures in place. Interestingly, local herbalists consider it one of the most in-demand medicinal plants in Nepal (Singh, 2020). The objectives of this study are to record traditional knowledge about *S. alata* across 6 districts communities in Nepal and evaluate the variety of its applications as well as develop recommendations for its long-term conservation.

Methodology

Study area

The occurrence of species was obtained from personal observation, published literature reports and government herbaria. Ethnobotanical data were collected from six districts which were chosen from eastern and central Nepal. All these district are home to many tribal and local communities including Bhraman, Chhetri, Tamang, Rai, Limbu, Sherpa, Gurung and Magar. Habitat verification was conducted at various sites in the eastern and central district of Nepal on the basis of availability of plants, namely Morang, Dhankuta, Kathmandu, Makwanpur, Chitwan and Nawalparasi Susta Purba.

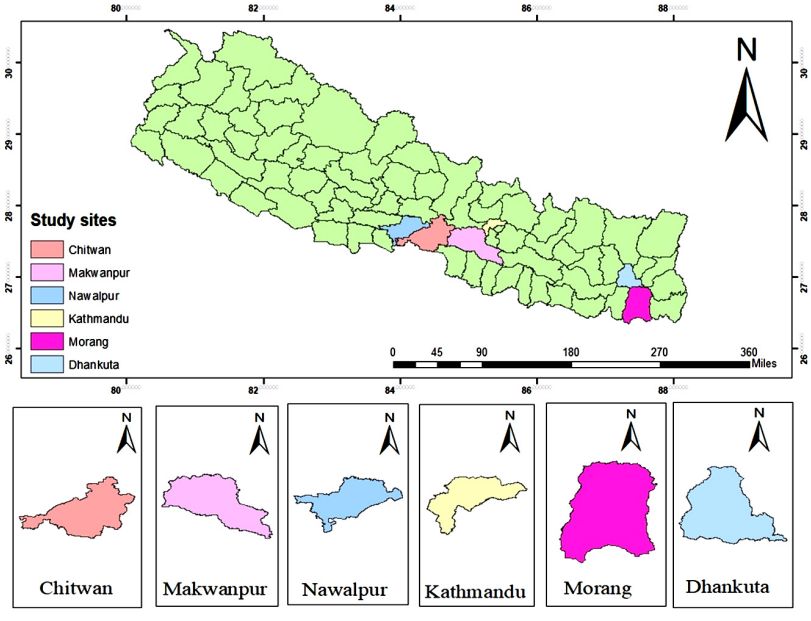

Figure 1. Map of study site

Study species

Senna alata (L.) Roxb. is a member of the caesalpinoideae subfamily of fabaceae family thrives in moist, well-drained soils in either sunny or semi-shaded locations and is commonly found along roadsides and riverbanks in tropical to temperate zones (Hennebelle et al., 2009). *Senna alata*, commonly called candle bush and is known as 'dajpatta' in Nepal (Karki et al., 2023). It grows as an annual or biennial shrub in tropical regions, typically attaining heights of 1–4 meters. This plant emits a distinct odor and displays yellowish-green leaves with 5–14 pairs of leaflets that broaden toward the apex, the terminal leaflets are notably larger with emarginate tips (Osunga et al., 2023). The shrub produces striking bright yellow zygomorphic flowers arranged in erect, compact racemes resembling golden spikes. Each flower contains seven stamens (two conspicuously elongated) and a pubescent ovary. Its fruit is a distinctive tetragonal pod

(10–16 cm × 1.5 cm) with winged margins, which turns brown at maturity and contains up to 60 rhomboid brown seeds(Pandey, 2021) . *Senna alata* is generally propagated through seeds and can be found up to 1500 meters above sea level (Oladeji et al., 2020).

Figure 2. *Senna alata* (L.) Roxb.

Data collection

The structured questionnaire was developed to document indigenous knowledge from local experts and traditional healers, utilizing visual aids of the plant species and its morphological parts to facilitate accurate identification. Field surveys were conducted random sampling method from available site of six studied districts between March and November 2024 to systematically record ethnobotanical uses and local practices related to the species. The study sites were strategically chosen based on species occurrence data obtained from the Global Biodiversity Information Facility (GBIF).

The study engaged 90 participants through focus group discussions and semi-structured interviews. The participants were predominantly traditional healers, teachers and housewives. The research instruments addressed multiple ethnobotanical dimensions including: vernacular nomenclature, temporal availability trends, identification techniques, utilization practices (including plant parts employed and preparation methods), therapeutic applications and indigenous conservation approaches.

Data Analysis

To evaluate the community's knowledge and application of *S. alata*, the study employed a quantitative analysis using several statistical ethnobotanical indices. These included measures for interviewee diversity (ID) and equitability (IE), use diversity (UD) and equitability (UE), as well as consensus values for methods of use (CMU) and plant parts used (CPP), following the methodology of (Albuquerque et al., 2006; Byg & Balslev,

2001). These indices quantify the plant's applications and how widely knowledge of them is shared by respondents. Data were analyzed descriptive statistics by using MS-excel and SPSS.

Table 1.

Index	Explanation	Reference
Interviewee diversity value (ID)	The ID value measures how many different people in a community know about and use a plant. A high ID value means knowledge of the plant is widespread among many people. A low ID value suggests that only a few individuals know about it.	(Byg & Balslev, 2001)
Interviewee equitability value (IE)	The Interviewee Equitability (IE) value measures how evenly knowledge of a plant is distributed among the people in a community.	(Byg & Balslev, 2001)
Use diversity value (UD)	The Use Diversity (UD) value quantifies the variety of distinct applications or uses reported for a specific plant species.	(Byg & Balslev, 2001)
Use equitability value (UE)	The Use Equitability (UE) value measures how evenly the different uses of a plant are cited within a community. It indicates whether the plant's applications are balanced or dominated by a few primary uses.	(Byg & Balslev, 2001)
Consensus value for plant parts (CPP)	The Consensus Value for Plant Parts (CPP) measures the level of agreement among people about which specific part of a plant (e.g., leaves, roots, bark) is used for a given purpose.	(Albuquerque et al., 2006)
Consensus value for the form of use (CMU)	The Consensus Value for the Form of Use (CMU) measures the level of agreement among people about how a plant is prepared or administered	(Albuquerque et al. 2006)

Result

Characteristic of Respondents

The study outlined the main demographic traits of the participants such as their gender and age. Female respondents were more (56.66%) than male respondents (43.33%). The age group 46-65 was the most represented with 52.22% and smallest group is in the oldest cohort (66+) representing just 21.11%. A detailed breakdown of characteristic of respondents is given in table 2.

Table 2. Characteristic of Respondents

Indicator	Description	Male Respondents (%)	Female Respondents (%)	Total Respondents (%)
Age of respondents	25-45	10.00	16.67	26.67
	46-65	21.11	31.11	52.22
	66+	12.22	8.88	21.11
Total		43.33	56.66	100

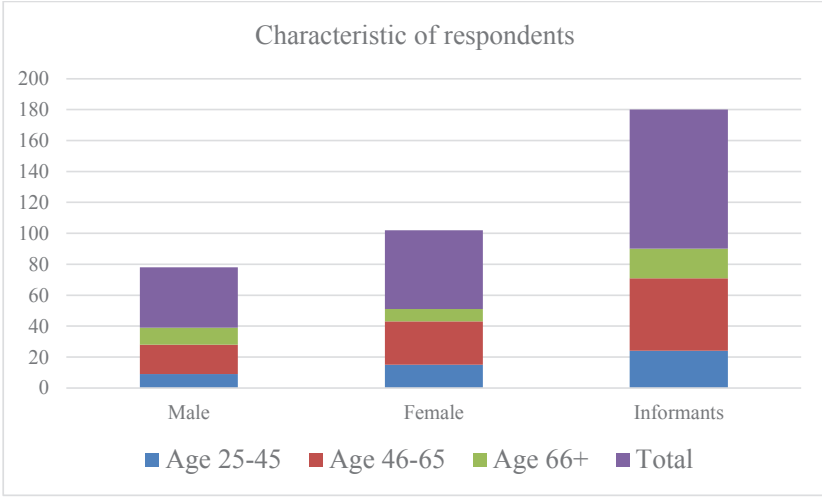

Figure 3. Characteristic of respondents

Knowledge diversity of *Senna alata*

Within the study area, a comprehensive uptake of *Senna alata* was observed across the entire respondent base. The informant diversity index (ID) ranged from 0.866 to 1.034 (Table 3). Overall, men showed greater knowledge of *Senna alata* use (ID=1.034 and IE=0.941). Women also showed considerable knowledge about species with ID = 0.866 and IE = 0.788.

Three principal categories for the application of *S. alata* were identified these are medicinal, nutritional and rituals. Therapeutic applications particularly in skin disease were the most frequently reported use of the plant in respondents surveyed with various ailments being treated using specific plant parts. The plant was also used for food and rituals purposes though these uses were less common. The plant has a versatile application in traditional medicine with strong focus on dermatological issues (skin disease and wound) but also with significant use for internal problems like constipation digestion and cough. A detailed breakdown of knowledge diversity is presented in Table 3.

Table 3. Knowledge assessment of *S. alata*

Total number of surveyed	90				
Number of specific uses cited	6				
Number of use categories cited	3				
		ID	IE	UD	UE
Male		1.034	0.941		
Female		0.866	0.788		
Ailments categories				1.419	0.793
Uses categories				0.75	0.684

ID= Interviewee diversity value, IE= Interviewee equitability value, UD= Use diversity value, UE= Use equitability value

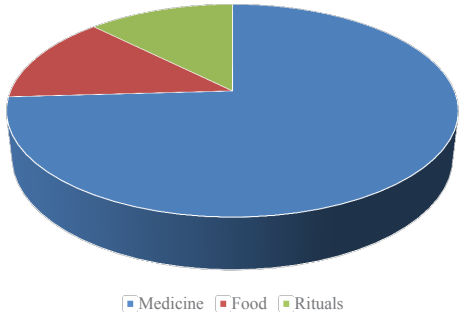

Figure 4. Use categories

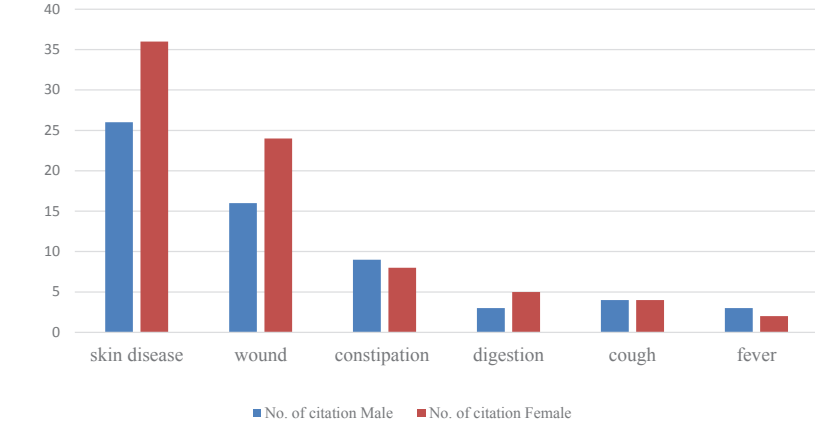

Figure 5. Use of plant for different ailments

Consensual value of forms of uses of *S.alata*

Several traditional preparation methods for extracting the bioactive constituents from *S. alata* were documented in the study. The techniques employed by the community

included decoction, paste, cooked and infusion. Of these techniques, decoction was the predominant preparation method (CMU = 75.56%), with paste (CMU = 35.56%), cooked (CMU = 12.22%) and infusion (CMU= 8.89%) being less common. Based on consensus site, the study concluded that decoction was not only the most popular but also the most potent technique for extracting the plant's bioactive compounds.

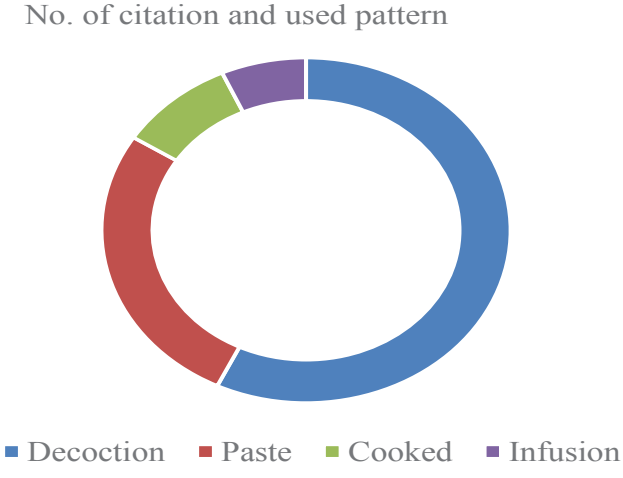

Figure 6. Consensual value of forms of uses

Consensual value for the parts uses

The whole plant parts of *Senna alata* are used for medicinal purposes as therapeutic application, with leaves being the most prevalent based on a high consensus value (CPP = 81.11%). Flowers (CPP=25.56%), seed (CPP = 20%), stem (CPP=7.78%) and root (CPP = 2.22%) were also used, though less frequently. These plant parts are widely used in the preparation of medicines, particularly for the treatment of skin disease and wound. The roots are used to treat fever and seeds and stem are used to treat constipation and digestion.

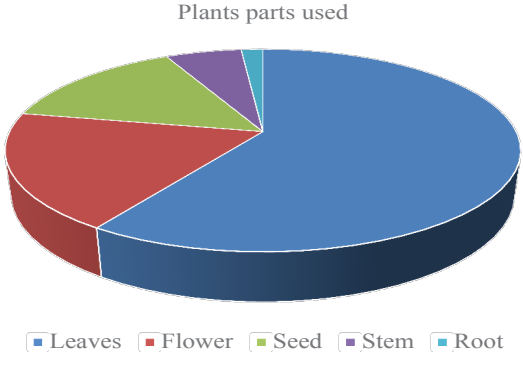

Figure 7. Consensual value for the parts uses

Discussion

Ethnobotanical knowledge of *S. alata*

The current ethnobotanical investigation yields a comprehensive elucidation of the diverse therapeutic applications of *S. alata*. It is integral to Nepalese traditional medicine, particularly for skin disease and constipation treatment. Ethnobotanical knowledge of this plant is not uniformly distributed. It is significantly influenced by demographic factors with older generations (40+) and specific genders demonstrating higher proficiency in its uses. Such variation underscores the greater depth of indigenous knowledge retained by older individuals, pointing to an expertise acquired through a lifetime of engagement with traditional phytotherapy. This culturally significant knowledge is transmitted intergenerationally, forming a continuous chain of learning (Amjad et al., 2020; Sen et al., 2011). This pattern of knowledge being concentrated among older demographics is consistent with global ethnobotanical studies. For instance, research in the Indian Himalayas found a marked decline in plant-based knowledge among youth under 25 (Chandra & Uniyal, 2021).

Medicinal importance and form of uses of *S. alata*

An assessment of *S. alata* importance within local communities found its primary use is in traditional medicine a finding consistent across all respondents groups. The species' considerable medicinal properties are catalyzing its integration into novel herbal treatments for a range of ailments. This growing application is due to its rich phytochemical composition including flavonoids, saponins, alkaloids, tannins, terpenes and glycosides which is documented to underpin its therapeutic potential (Karki et al., 2023; Onyegeme-Okerenta & Essien, 2021). Scientific research have confirmed the efficacy of the plant's extracts revealing significant antibacterial, antifungal, antidiabetic and anticancer activities (Ramamoorthy, 2018). The analysis revealed that knowledge of how to use *S.alata* varies by local communities. However, some previously documented uses are identical to those found here. The decoction method is the predominant technique used by all respondents groups to extract active compounds, especially when treating skin disease, constipation and fever. This widespread use of decoction is well-documented in similar international studies (Amjad et al., 2020; Kankara et al., 2018).

The organs of a plant are storehouses of active ingredients used to treat various illnesses, though their uses vary by species. The leaves of *S. alata* are the most frequently used part in treatments and are in fact involved in every category of use. This finding is consistent with prior research of (Suriya et al., 2023). Several studies report that the population uses the leaves of 84.9% of the documented medicinal plants to make remedies. Overall, our findings on the utilization of *S. alata* plant parts align with this established pattern.

Conclusion

This investigation examined the traditional uses and associated ethnobotanical knowledge of *S. alata* in Nepal. The study's results revealed that *S. alata* is a widely recognized plant, playing a major role in traditional medicine. Its usage and the knowledge about it are not uniform but vary significantly based on demographic factors including a respondent's age, gender and cultural group. While the plant is prepared in multiple ways for treatments, the most prevalent method is decoction. Medicinal preparations utilize all sections of the plant for various therapeutic purposes, with the leaves being the most frequently employed part. Despite its valued status, *S. alata* is subject to conservation concerns from overharvesting and ecological conflicts due to its invasive potential in non-native regions. A proactive management strategy is essential for its sustained availability. The primary strategy recommended is the promotion of cultivation in home gardens and community plots. This ex-situ conservation method serves a dual purpose. It ensures reliable access to the plant especially in urbanized areas of Nepal where natural populations have disappeared due to habitat loss and overharvesting making it scarce. This practice safeguards both the biological species and the associated traditional knowledge.

Declaration: Competing interests: Authors declare no conflict of interest.

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