

A Review on *Sesbania sesban*: Botanical, Phytochemical, Medicinal and Agricultural Importance

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Abstract

Sesbania sesban is a fast-growing, multipurpose leguminous plant widely distributed across tropical and subtropical regions. It is well known for its adaptability, as it can grow in poor soil conditions and waterlogged environments, making it highly valuable for ecological and agricultural applications. Botanically, it is a hardy shrub that contributes significantly to environmental sustainability.

The plant is rich in a variety of bioactive compounds, including flavonoids, saponins, tannins, alkaloids, and phenolic acids. These phytochemicals are responsible for its diverse pharmacological properties. Traditionally, *Sesbania sesban* has been used in herbal medicine for the treatment of inflammation, infections, diabetes, and liver-related disorders. Contemporary scientific studies have validated many of these uses, demonstrating its antioxidant, antimicrobial, anti-inflammatory, and antidiabetic activities, which highlight its therapeutic potential.

In addition to its medicinal importance, *Sesbania sesban* plays a crucial role in sustainable agriculture. As a nitrogen-fixing plant, it naturally enhances soil fertility, thereby reducing dependence on synthetic fertilizers. It is widely utilized as green manure and serves as a nutritious fodder source for livestock due to its high protein content. Furthermore, its rapid growth and high biomass production make it an ideal candidate for agroforestry systems and land restoration, particularly in degraded and nutrient-deficient soils.

Overall, *Sesbania sesban* is an important plant with significant benefits for both healthcare and agriculture. However, further research is required to fully characterize its active compounds and confirm its clinical efficacy, ensuring safe, effective, and sustainable utilization in the future.

Keywords : Medicinal plant, Phytochemicals, Antimicrobial activity, Antioxidant activity, Ethnomedicinal uses

I. INTRODUCTION

Sesbania sesban, commonly referred to as Egyptian sesban, is a fast-growing leguminous plant belonging to the Fabaceae family, widely distributed across tropical and subtropical regions including India, Malaysia, Indonesia, and the Philippines. It commonly thrives along rice field margins, roadsides, and in household gardens. Botanically, it is characterized as a soft, semi-woody perennial tree that can attain a height of up to 8 meters with a stem diameter of approximately 12 cm. A notable feature of this species is its exceptionally rapid growth, reaching heights of 4–5 meters within six months under favorable conditions. As a nitrogen-fixing plant, it plays a crucial role in improving soil fertility and supporting sustainable agricultural practices.

Traditionally, *Sesbania sesban* has been extensively utilized for both medicinal and agricultural purposes. Various plant parts, including leaves, seeds, and pods, are employed in herbal medicine. The leaves possess laxative, demulcent, anti-inflammatory, and analgesic properties, and are commonly applied externally for the treatment of boils, abscesses, and joint inflammation. Additionally, leaf extracts exhibit anthelmintic activity, contributing to their therapeutic significance [1,2].

Phytochemically, the plant is rich in a diverse array of bioactive compounds such as steroids, glycosides, saponins, tannins, proteins, amino acids, vitamins, carbohydrates, and triterpenoids. Key constituents, including delphinidin, cyanidin, and oleanolic acid, are known to enhance its medicinal value. Owing to this complex chemical composition, *Sesbania sesban* demonstrates a broad spectrum of pharmacological activities, including hepatoprotective, antimicrobial, anti-inflammatory, antidiabetic, antioxidant, antinociceptive, and central nervous system stimulant effects.

In conclusion, *Sesbania sesban* holds significant ethnomedicinal and pharmacological importance. Its wide range of therapeutic properties, coupled with its agricultural benefits, underscores its potential as a valuable resource for the development of plant-based therapeutic agents [3,4].



Figure 1: *Sesbania sesban* plant

II. BOTANICAL DESCRIPTION

Sesbania sesban Linn., commonly known as Egyptian sesban, is a fast-growing, nitrogen-fixing shrub or small tree belonging to the genus *Sesbania*. It is widely cultivated for its role in improving soil fertility and serving as a windbreak. [4]The plant typically grows up to 8 meters in height and is characterized by pinnately compound leaves with multiple pairs of narrow leaflets. Its flowers are arranged in racemes and are yellow with distinct purple or brown streaks. The plant produces elongated, cylindrical pods containing numerous seeds. Although several botanical varieties of *Sesbania sesban* have been identified, their differences have limited impact on agricultural performance.[5]

Classification

Kingdom	Plantae
Subkingdom	Tracheobionta (Vascular plants)
Superdivision	Spermatophyta (Seed plants)
Division	Magnoliophyta (Flowering plants)
Class	Magnoliopsida (Dicotyledons)
Order	Fabales
Family	Fabaceae (Leguminosae)
Genus	<i>Sesbania</i>
Species	<i>Sesbania sesban</i> (L.) Merr.[6]

➤ Morphological parts of plant /Medicinal uses

Leaves

Leaves are compound, pinnate, and arranged alternately along the stem. Each leaf consists of numerous small, oblong leaflets. The foliage is soft, green, and contributes significantly to photosynthesis and nutrient cycling, making it valuable as green manure and fodder.[1]



Figure 2: leaves

StemThe stem is erect, soft, and semi-woody, typically reaching 3–8 meters in height. It is green and smooth in young stages, gradually becoming slightly woody with age. The stem is often branched, contributing to rapid biomass production and making the plant suitable for fodder and agroforestry purposes.[1]

Flowers

The flowers are yellow, papilionaceous (pea-like), and borne in axillary racemes. They are typically medium-sized and attractive, playing a key role in reproduction through pollinator attraction. Flowering occurs abundantly under favorable conditions.[7]



Figure 3: Flowers

Seed

Seeds are small, smooth, and typically brown to dark-colored. They are hard-coated, enabling dormancy and long-term viability. Seeds are the primary means of propagation and are well adapted for survival under harsh environmental conditions.[7]



Figure No 4: Seeds

Root

The plant possesses a well-developed taproot system with numerous lateral roots. These roots contain nitrogen-fixing nodules, which enhance soil fertility through symbiosis with *Rhizobium* bacteria. The root system provides strong anchorage and supports growth in diverse soil conditions, including marginal lands [7].

Geographical Distribution

Sesbania sesban is a well-recognized plant species first formally described in 1912. It is naturally found across tropical and southern Africa, the Arabian Peninsula, and the Indian subcontinent, and has been widely introduced to other regions such as South America, Madagascar, and parts of the Himalayas. This species typically grows as a shrub or small tree in seasonally dry tropical environments [8, 9]. According to its latest assessment on the IUCN Red List (2019), *Sesbania sesban* is classified as “Least Concern,” with a stable population and no major threats currently identified, although increasing harvesting levels warrant monitoring [10]. The plant holds significant economic and ecological value, being used for fiber, food, animal forage, medicinal purposes, and timber. Additionally, its cytotoxic properties indicate promising pharmaceutical potential, emphasizing the need for further research into its bioactive compounds.

III. PHYTOCHEMICAL CONSTITUENTS

Phytochemical investigations of *Sesbania sesban* have consistently demonstrated the presence of a wide range of bioactive constituents, including carbohydrates, proteins, amino acids, glycosides, saponins, tannins, alkaloids, phenolic compounds, and flavonoids. These compounds contribute to the plant's significant pharmacological potential and support its traditional medicinal applications [11]. Pods and leaves contain phytosterols such as cholesterol, campesterol, and β -sitosterol. Flowers possess anthocyanin glycosides, while pollen and pollen tubes contain organic acids including α -ketoglutaric, oxaloacetic, and pyruvic acids [12]. Phytochemical studies indicate that *Sesbania sesban* seeds contain oleanolic acid, stigmastane derivatives, and galactomannan. The oleanolic acid 3- β -D-glucuronide has been isolated from root extracts. These constituents highlight the plant's significant bioactive and pharmacological potential [13]. Studies on *Sesbania* species show that dried leaves contain higher levels of crude protein and crude fibre compared to fresh leaves [14]. The *Ayurvedic Pharmacopoeia of India* reports the presence of essential minerals such as calcium and phosphorus [15].

Table No: 1 Chemical Constituents of *Sesbania sesban*

Parts	Constituent
Leaf and Pods	Cholesterol, Campesterol, Beta-sitosterol
Leaf	Carbohydrates, Glycosides, Proteins, Amino acids, Saponins, Tannins, Alkaloid, Phenolic compounds, Flavonoids, Crude protein and Crude fibre
Flowers	Cyanidin and Delphinidin Glucosides
Pollen and pollen tubes	α -ketoglutaric, oxaloacetic and pyruvic acids
Seeds	oleanolic acid, stigmastane-5.24(28)-diene-3 β -O- β -D-galactopyranoside and galactomannan
Root	Oleanolic acid 3- β -D-glucuronide

Uses of *Sesbania sesban*

Traditional uses

All parts of *Sesbania sesban*, including seeds, bark, and leaves, are traditionally used in managing conditions such as menorrhagia, splenic enlargement, diarrhea, and helminthic infections, and exhibit astringent, emmenagogue, and anti-inflammatory properties. Bark juice is applied for skin eruptions, while leaves are recommended in Ayurveda for the treatment of dysuria [16].

Table No: 2 Traditional Uses of *Sesbania sesban*

Parts of plant	Traditional Uses
Seeds	Astringent, emmenagogue; used in menorrhagia, spleen enlargement, and diarrhoea
Unsaponifiable matter of seed oil	Cardiac depressant, antibacterial
Leaves	Anti-inflammatory; used in dysuria
Bark juice	Applied externally for cutaneous eruptions
	Leaf juice (oral use)

Ethnomedicinal uses

Treating livestock diseases

Sesbania sesban is widely utilized in ethnoveterinary medicine for the treatment of livestock diseases across different regions [17]. Studies conducted in Bangladesh have reported that the leaves are administered orally to manage urinary retention in cattle, goats, and buffaloes [18]. The ethnoveterinary surveys from the Bagerhat district indicate that leaves and stems are applied externally to alleviate pain associated with pox infections in cattle; the dried leaves are spread over the animal's body, and brushing with stems and leaves is practiced to enhance the therapeutic effect. In Southern Ethiopia, pastoral communities employ the roots and bark of *S. sesban* for the treatment of mastitis. Infusions prepared from these plant parts are applied topically to control infection and inflammation [19]. These traditional practices highlight the plant's significant role in livestock healthcare and suggest its potential antimicrobial and anti-inflammatory properties, warranting further scientific validation.

Treating malaria

Ethnomedicinal studies from Zambia and Madagascar report that *Sesbania sesban* is traditionally used in malaria management. In Zambia, vapors from boiled leaves are inhaled twice daily for three days, while in Madagascar, a decoction of the aerial parts is consumed orally to treat malaria [20].

Mosquito repellent

Studies in India report that *Sesbania sesban* leaves are traditionally used as a natural mosquito repellent for livestock. Leaf extracts are applied by washing animals to reduce insect infestation, while leaf decoctions are administered as cattle drench to repel tsetse flies [21].

IV. PHARMACOLOGICAL ACTIVITIES

Antioxidant Activity

Anthocyanins were successfully extracted from *Sesbania sesban* flower petals using methanol and acidified methanol. The extracted compounds demonstrated significant antioxidant activity, exhibiting a clear dose-dependent increase in free radical scavenging ability. Specifically, the anthocyanins were effective against DPPH radicals, superoxide anions, and hydroxyl radicals, indicating their strong potential as natural antioxidants with possible applications in health and pharmaceutical fields [22, 23].

Anti-inflammatory Activity

The topical anti-inflammatory activity of crude saponins extracted from *Sesbania sesban* leaves was evaluated using the carrageenan-induced rat paw edema model. Gel formulations containing 1% w/w and 2% w/w saponin extracts were tested on Wistar albino rats, with diclofenac sodium gel (1% w/w) serving as the standard reference. The results demonstrated that the 2% w/w saponin gel exhibited significant anti-inflammatory activity, indicating the potential of *Sesbania sesban* leaf saponins as an effective natural agent for topical inflammation management [24].

The anti-inflammatory effects of petroleum ether, chloroform, and methanol extracts derived from the bark of *Sesbania sesban* and *Sesbania grandiflora* were evaluated using the carrageenan-induced paw edema model in rats. Among the different extracts tested, the petroleum ether extracts of both plant species exhibited superior anti-inflammatory activity compared to the chloroform and methanol extracts. These findings suggest that non-polar constituents present in the bark may play a key role in mediating the observed anti-inflammatory effects.

Antimicrobial Activity

Kathiresh et al. (2012) provided evidence supporting the antimicrobial activity of *Sesbania sesban* flower extracts using the disc diffusion assay. The study demonstrated that the extracts produced measurable zones of inhibition at varying concentrations, indicating antibacterial efficacy. Notably, the extracts were effective against Gram-positive bacteria, including *Staphylococcus aureus* and *Staphylococcus saprophyticus*, after 24 hours of incubation. In contrast, no inhibitory effect was observed against the tested Gram-negative bacteria. According to these results, *S. sesban* flower extracts have more potent antibacterial action against Gram-positive bacteria [25].

Arif Ahmed et al. (2013) demonstrated the antimicrobial potential of *Sesbania sesban* bark extracts, supporting its traditional medicinal use. Phytochemical analysis revealed the presence of bioactive compounds such as carbohydrates, flavonoids, steroids, alkaloids, tannins, and saponins. In disc diffusion assays, chloroform (250 and 500 µg/ml) and ethanol (500 µg/ml) extracts exhibited broad-spectrum antibacterial activity against both Gram-positive and Gram-negative bacteria. The ethanol extract at 250 µg/ml and ether extracts showed slightly reduced activity, with limited ineffectiveness against *Proteus vulgaris* and *Enterococcus faecalis*. Overall, the study highlights the strong antimicrobial efficacy of *S. sesban* bark extracts [26].

Anthelmintic Activity

Ibrahim (1992) investigated the in vitro anthelmintic activity of *Sesbania sesban* using *Caenorhabditis elegans* as a model organism. The aqueous leaf extract exhibited significant activity, achieving 30% and 96% nematode mortality after 2 and 6 hours of exposure at a concentration of 2.5 mg/mL, respectively. In contrast, seed extracts showed comparatively lower efficacy, with mortality ranging from 5.6% to 25.5% across concentrations of 0.25–50 mg/mL. The study concluded that *S. sesban* leaves possess strong anthelmintic potential, with an LC₅₀ value of 8.0 mg/mL, indicating higher effectiveness than other plant species evaluated [27].

Anti-bacterial activity

Mythili and Ravindhran (2012) reported that methanolic and ethanolic extracts of *Sesbania sesban* contain a diverse range of bioactive phytochemicals, including alkaloids, flavonoids, phenolic compounds, phytosterols, fixed oils, and gums. Their study further demonstrated the antibacterial potential of the plant, particularly the methanolic stem extract, which was evaluated against multiple bacterial strains. The extract exhibited activity against both Gram-positive pathogens—such as *Staphylococcus aureus*, *Enterococcus faecalis*, *Escherichia coli*, and *Bacillus subtilis*—and Gram-negative pathogens, including *Salmonella typhi*. These findings suggest that *S. sesban* possesses significant antimicrobial properties, supporting its potential use as a natural source of therapeutic agents [28].

The study demonstrated that *Sesbania sesban* extract exhibits notable antibacterial activity, with the highest inhibition observed against *Erwinia amylovora* (17.25 mm), followed by *Escherichia coli* (16 mm) at a concentration of 250 µg/ml. Overall, stronger antibacterial effects were recorded at concentrations of 250 µg/ml and 500 µg/ml across most tested bacterial strains. When compared with the standard flavonoid quercetin, the plant extract showed considerable inhibitory effects against several pathogens, including *Bacillus subtilis*, *Escherichia coli*, *Enterococcus faecalis*, *Erwinia amylovora*, and *Shigella dysenteriae*.

Additionally, ethnomedicinal evidence supports these findings, as reported by Elegami et al. (2001), where the leaves and fruits of *S. sesban* are traditionally used in Sudanese folk medicine for the treatment of sore throat and gonorrhoea. These results collectively highlight the plant's potential as a source of effective antimicrobial agents [29].

Anti-fungal activity

Mythili and Ravindhran (2012) demonstrated that the methanolic stem extract of *Sesbania sesban* possesses significant antifungal activity against several pathogenic fungi. Using the disc diffusion method, complete inhibition was observed against *Curvularia lunata* and *Fusarium oxysporum* at concentrations of 100 µg/ml and 500 µg/ml. Other fungi, including *Aspergillus fumigatus* and *Verticillium glaucum*, also showed greater susceptibility at higher concentrations (500 µg/ml). Overall, the findings indicate that *S. sesban* stem extract exhibits broad-spectrum antimicrobial activity against both fungal and bacterial pathogens [28].

Arif Ahmed et al. (2013) reported that *Sesbania sesban* bark extracts exhibit measurable antifungal activity against a range of pathogenic fungi. Using the disc diffusion method, the highest inhibition was observed against *Fusarium oxysporum* (14.2 mm). Minimum inhibitory concentration (MIC) testing indicated that effective inhibition required relatively high concentrations (up to 8000 µg/ml), exceeding those used in the disc assay (250–500 µg/ml). Overall, the study suggests moderate antifungal potential of *S. sesban* bark extracts [26].

Antidiabetic activity

Pandhare et al. (2011) demonstrated that the aqueous leaf extract of *Sesbania sesban* possesses significant antidiabetic activity in streptozotocin-induced diabetic rats. Improved metabolic parameters, such as elevated body weight, liver glycogen, serum insulin, and HDL cholesterol levels, as well as decreased blood glucose, glycosylated hemoglobin, total cholesterol, and triglycerides, were observed after oral administration at doses of 250 and 500 mg/kg/day for 30 days. The results were similar to those of glibenclamide, a common medication. Interestingly, normal rats were not significantly affected by the extract. According to the study's overall findings, *S. sesban* leaf extract may help control hyperglycemia and related lipid abnormalities [30].

Sesbania sesban root extract significantly lowers blood sugar levels in streptozotocin-induced type 2 diabetic mice, according to Manjusha et al. (2012). Fasting blood glucose levels were significantly lowered by oral treatment at dosages of 250, 500, and 1000 mg/kg. Additionally, the extract enhanced biochemical markers by raising insulin, HDL cholesterol, and total protein levels while decreasing cholesterol, triglycerides, urea, and creatinine. These results point to its possible therapeutic use in the treatment of type 2 diabetes [31].

V. AGRICULTURAL USES

Sesbania sesban is a fast-growing, nitrogen-fixing leguminous tree that breaks down quickly when added to the soil, making it a useful green manure for enhancing soil fertility [32]. In the Ethiopian highlands, *Sesbania sesban*, an imported multipurpose fodder tree, is frequently used for soil protection and livestock feeding. Research has shown that supplementing it increases feed intake, makes the baseline diet easier to digest, and helps animals grow more effectively [33]. *Sesbania sesban* is important for increasing animal productivity since it not only improves feed digestibility but also positively affects rumen fermentation and increases milk production in animals [34]. Additionally, it is regarded as a suitable and safe feed additive for cattle, even during the reproductive cycle, supporting its usage in enhancing animal productivity and health without negative consequences [35].

VI. FUTURE PERSPECTIVES

Future research on *Sesbania sesban* should focus on the detailed isolation, characterization, and standardization of its bioactive compounds to better understand their mechanisms of action and therapeutic potential. Although existing studies support its pharmacological and agricultural importance, there is a critical need for well-designed clinical trials to validate its safety, efficacy, and dosage in humans and animals. Additionally, advanced biotechnological approaches and molecular studies can help enhance its medicinal properties and improve crop productivity. Exploring its role in sustainable agriculture, particularly in soil restoration, climate-resilient farming, and eco-friendly livestock nutrition, also presents promising opportunities. Overall, *Sesbania sesban* holds significant potential for future development as a

natural therapeutic agent and a sustainable agricultural resource, provided that further scientific validation and standardization are achieved.

VII. CONCLUSION

In conclusion, *Sesbania sesban* emerges as a highly valuable multipurpose plant with significant pharmacological and agricultural importance. The review highlights its rich phytochemical profile, which underpins diverse biological activities including antimicrobial, antifungal, anthelmintic, and antidiabetic effects, alongside its proven role in enhancing soil fertility and livestock productivity. Despite promising experimental evidence, most findings remain confined to in vitro and animal studies, necessitating rigorous clinical validation. Future research should prioritize the isolation and standardization of bioactive compounds, mechanistic studies, and well-structured clinical trials to establish safety, efficacy, and dosage. Additionally, integrating advanced biotechnological approaches could enhance its therapeutic potential and agronomic performance. Overall, *S. sesban* holds strong promise as a sustainable natural resource for both medicinal applications and climate-resilient agricultural systems, provided scientific gaps are systematically addressed.

VIII. REFERENCES

- [1] Gomase PV. *Sesbania sesban* Linn: a review on its ethnobotany, phytochemical and pharmacological profile. Asian journal of biomedical and pharmaceutical sciences. 2012 Jan 1;2(12):11.
- [2] Dobriyal RM, Narayana DB. Ayurvedic herbal raw material. Eastern pharmacist. 1998;41(484):31-5.
- [3] Macklin B, Anderson DM. Perennial *Sesbania* Production and Use: A Manual of Practical Information for Extension Agents and Development Workers. Nitrogen Fixing Tree Association; 1990.
- [4] Kirtikar KR, Basu BD. Indian medicinal plants 2nd edition. M/S Bishen Singh Pal Singh, Delhi. 1975:1465-72.
- [5] Mani RP, Awanish P, Shambaditya G, Poonam T, Kumudhavalli V, Pratap SA. Phytochemical Screening and In-vitro Evaluation of Antioxidant Activity and Antimicrobial Activity of the Leaves of *Sesbania sesban* (L) Merr. Free radicals and antioxidants. 2011 Jul 1;1(3):66-9.
- [6] Duke JA. Handbook of medicinal herbs. CRC press; 2002 Jun 27.
- [7] Gomase PV. *Sesbania sesban* Linn: a review on its ethnobotany, phytochemical and pharmacological profile. Asian journal of biomedical and pharmaceutical sciences. 2012 Jan 1;2(12):11.
- [8] Plants of the World Online (POWO). Plants of the World Online. Royal Botanic Gardens, Kew; 2024.
- [9] Betts J, Young RP, Hilton-Taylor C, Hoffmann M, Rodríguez JP, Stuart SN, Milner-Gulland EJ. A framework for evaluating the impact of the IUCN Red List of threatened species. Conservation Biology. 2020 Jun;34(3):632-43.
- [10] Mokhtar FA, Ahmed M, Al Dhanhani AS, Elbehairi SE, Alfaifi MY, Shati AA, Fakhry AM. Distribution, Phytochemical insights, and cytotoxic potential of the *sesbania* genus: A comprehensive review of *Sesbania grandiflora*, *Sesbania sesban*, and *Sesbania cannabina*. Pharmaceuticals. 2025 Jan 9;18(1):64.
- [11] Mani RP, Awanish P, Shambaditya G, Poonam T, Kumudhavalli V, Pratap SA. Phytochemical Screening and In-vitro Evaluation of Antioxidant Activity and Antimicrobial Activity of the Leaves of *Sesbania sesban* (L) Merr. Free radicals and antioxidants. 2011 Jul 1;1(3):66-9.
- [12] Khare CP. Indian medicinal plants: an illustrated dictionary. Berlin: Springer; 2007. p. 601.
- [13] Das N, Chandran P, Chakraborty S. Potent spermicidal effect of oleanolic acid 3-beta-D-glucuronide, an active principle isolated from the plant *Sesbania sesban* Merrill. Contraception. 2011 Feb 1;83(2):167-75.

- [14] Robertson BM. The nutritive value of five browse legumes fed as supplements to goats offered a basal rice straw diet. University of Queensland.; 1988.
- [15] The Ayurvedic Pharmacopoeia of India, Part-I, Volume-II, First Edition, 1999, 60-61
- [16] Prakash V, Mehrotra BN. Anthelmintic plants in traditional remedies in India. Indian journal of history of science. 1987;22(4):332-40.
- [17] Tanzin R, Ghosh KC, Jahan R, Khatun A, Rahmatullah M. An ethnoveterinary survey of medicinal plants used to treat cattle diseases in Birishiri area, Netrakona district, Bangladesh. Advances in Natural and Applied Sciences. 2010 Jan 1:10-4.
- [18] Ahmmed FI, Sintaha M, Khaleque HN, Majeedul H, Chowdhury FA, Rahman S, Jahan R, Seraj S. An ethnoveterinary survey of medicinal plants used by folk medicinal practitioners to treat cattle diseases in randomly selected areas of Bagerhat district, Bangladesh. American-Eurasian Journal of Sustainable Agriculture. 2010;4(3):386-96.
- [19] Teshale Sori TS, Merga Bekana MB, Girma Adugna GA, Ensermu Kelbessa EK. Medicinal plants in the ethnoveterinary practices of Borana Pastoralists, Southern Ethiopia.
- [20] Rasoanaivo P, Petitjean A, Ratsimamanga-Urverg S, Rakoto-Ratsimamanga A. Medicinal plants used to treat malaria in Madagascar. Journal of Ethnopharmacology. 1992 Sep 1;37(2):117-27.
- [21] C. P. Khare, Indian Medicinal Plants: An Illustrated Dictionary. New Delhi 132001 - Himachal Pradesh, India: p. 900. Springer-Verlag New York., 2007.
- [22] Kathiresh M, Suganya P, Saravanakumar M. Antioxidant effect of Sesbania sesban flower extract. International Journal of Pharmaceutical Sciences. 2011;3(2):1307-12.
- [23] Mani RP, Awanish P, Shambaditya G, Poonam T, Kumudhavalli V, Pratap SA. Phytochemical Screening and In-vitro Evaluation of Antioxidant Activity and Antimicrobial Activity of the Leaves of Sesbania sesban (L) Merr. Free radicals and antioxidants. 2011 Jul 1;1(3):66-9.
- [24] Dande PR, Talekar VS, Chakraborty GS., Evaluation of crude saponins extract from leaves of Sesbania sesban (L.) Merr. for topical anti-inflammatory activity. Int. J. Res. Pharm. Sci.1
- [25] Kathiresh M, Suganya PD, Saravanakumar M. Bioactive compounds in Sesbania sesban flower and its antioxidant and antimicrobial activity. Journal of Pharmacy Research. 2012 Jan;5(1):293-390.
- [26] Arif Ahmed, Md. S. Islam Howlader, S. Kanti Dey, A. Hira and Md. H. Hossain, "Phytochemical screening, antimicrobial and cytotoxic activity of different fractions of Sesbania sesban bark," Int.J. Basic Med. Sci. Pharm., vol. 5, no. 4, p. 206, 2013, doi: 10.4103/1947-489x.210546.
- [27] Ibrahim AM. Anthelmintic activity of some Sudanese medicinal plants. Phytotherapy Research. 1992 May;6(3):155-7.
- [28] T. Mythili and R. Ravindhran, "Phytochemical screening and antimicrobial activity of Sesbania sesban (L.) Merr.," Asian J. Pharm. Clin. Res., vol. 5, no. 4, pp. 179–182, 2012.
- [29] A. A. Elegami, Aisha Z. Almagboul, Mohamed Elfatih A. Omer, and Mahgoub S. El Tohami, "Sudanese plants used in folkloric medicine: Screening for antibacterial activity. Part X," Fitoterapia, vol. 72, no. 7, pp. 810–817, 2001,
- [30] R. B. Pandhare, B. Sangameswaran, P. B. Mohite, and S. G. Khanage, "Antidiabetic activity of aqueous leaves extract of Sesbania sesban (L) Merr. in streptozotocin induced diabetic rats," Avicenna J. Med. Biotechnol., vol. 3, no. 1, pp. 37–43, 2011
- [31] Manjusha, N. Aggarwal, Nitesh and P. Gupta, "Effect of petroleum ether extract of Sesbania sesban (Merr.) roots in streptozotocin (STZ) induced diabetes in mice," Asian Pac. J. Trop. Biomed., vol. 2, no. 3 SUPPL., pp. S1254–S1260, 2012,

- [32] Patra AK, Chhonkar PK, Khan MA (2006). Effect of green manure Sesbania and nitrification inhibitor encapsulated calcium carbide (ECC) on soil mineral-N, enzyme activity and nitrifying organisms in a rice-wheat cropping system. *Eur. J. Soil Biol.* 42:173-180.
- [33] S.J. Oosting, A. Mekoya, S. Fernandez-Rivera, A.J. van der Zijpp, Sesbania as a fodder tree in Ethiopian livestock farming systems : Feeding practices and farmers' perception of feeding effects on sheep performance, *Livestock Science*, 2011, 139(1-2): 135-141.
- [34] Khalili, H., Varvikko, T., Effect of replacement of concentrate mix by wilted sesbania (*Sesbania*) forage on diet digestibility, rumen fermentation and milk production in Friesian X Zebu (Boran) crossbred cows fed low quality native hay, *Animal Feed Science and Technology*;1992;36(3-4):275-286.
- [35] Sabra HA, Hassan SG, Mohamed MI. Effect of *Sesbania* (*Sesbania aegyptiaca*) Supplementation on the Reproductive Performances of Baladi Sheep as Compared to Berseem (Egyptian Clover). *J. Reprod. Infertil*, 2010;1(3):66-70.