INFORMATICS JOURNALS

Short Review

Journal of Natural Remedies
DOI: 10.18311/jnr/2026/54795

eISSN: 2320-3358 | Vol 26(9), 2026 | pp. 2381-2389

Exploring Phytopharmacological Properties and Traditional Use of *Leptadenia pyrotechnica*

Yogita Shinde[1*], Rakesh Chaudhari[2], Mamta Chaudhary[1], Kanchan Chaudhary[1], Snehal Pardeshi[1], Arpita Rai[1] and Poonam Tiwari[1]

[1]Department of Pharmacy, Vishwakarma University, Pune – 411048, Maharashtra, India; galandeyogita@gmail.com

[2]Department of Mechanical Engineering, Pandit Deendayal Energy University, Gandhinagar – 382426, Gujarat, India

Abstract

Classical and traditional systems of medicine have unceasingly made meaningful and crucial contributions to universal health. In traditional medicine, therapeutic and beneficial plants provide new fields of drug research. As natural products are non-toxic and benign, have relatively few side effects and are consumed without difficulty, the demand for medicines consisting of plant-based products, dietary products, wellness items, medication, and skin care commodities is growing likewise in advanced nations. *Leptadenia pyrotechnica (L. pyrotechnica)* (Forssk.) Decne. is a therapeutic herb indigenous to the scorching desert of Rajasthan. It is known as *khimp* or *kheep*. *L. pyrotechnica* is a bush located predominantly in arid regions and belongs to the *Asclepiadaceae* family. All parts of the plant *L. pyrotechnica* are used in herbal remedies in a plethora of ways. The ethnopharmacological use of *L. pyrotechnica* has significant anti-inflammatory, antioxidant, germicidal, deworming, anti-lipoxygenase, cell- killing, anti-tumour, hypolipidemic, anti-microbial, and anti-atherosclerotic activities. In the present article, there is a specification of pharmacological activities and isolated components with structures in the plant *L. pyrotechnica.*

Major Findings: *Leptadenia pyrotechnica* is a bioactive-rich medicinal plant with notable antioxidant, anti-inflammatory, antimicrobial and antidiabetic properties. Its widespread traditional use in treating various ailments highlights its strong therapeutic potential.

Keywords: *Leptadenia pyrotechnica*, Pharmacological Activity, Photochemistry, Traditional Uses

(Article Chronicle: Article Received on: 13.02.2026; Revised on: 06.04.2026; Accepted on: 01.08.2026)

1. Introduction

Rajasthan is famous for its lively culture and sandy desert views. It's located roughly between 69°30′ and 78°17′E longitude and 23°3′ to 30°12′N latitude. Because the climate there is mostly dry, you'll find plants that have specially adapted to desert conditions. One example is *L. pyrotechnica*, which people often call "wild hiptage". This is a tough, long-lasting shrub that has really settled into desert living. It's quite important for the environment because its strong roots help keep dunes fromshifting[1-4].

People all over the world have long used medicinal plants because they offer affordable ways to treat illnesses. These plants contain special natural chemicals that are very useful, and they really help in preventing and handling new diseases. Many folks consider herbal medicines to be a safer choice since they usually come with fewer side effects and don't cost as much[5,6].

In India, there are four types of plants under the *Leptadenia* group: *Leptadenia pyrotechnica, Leptadenia reticulata, Leptadenia hastuta,* and *Leptadenia arborea*. Out of these, *Leptadenia pyrotechnica*, which belongs to the *Asclepiadaceae* family, mostly grows in dry parts

*Author for correspondence

of Asia and Africa, especially in sandy soils that don't have many nutrients. When you look at it, it's a tall, very branched shrub that usually doesn't have many leaves. Its stems are smooth and green, and they contain a milky liquid. The plant grows greenish-yellow flowers in clusters and then produces long, round pods filled with hairy seeds. You'll see it flowering and fruiting between August and January. People traditionally eat its pods as a vegetable, which really shows how nutritious it is[7,8]. There are different chemical constituent present in *L. pyrotechnica* like Sigma Sterol, Squalene Arginine [9] Etc Mention in Table 2[9].

When scientists looked closely at the chemicals in *L. pyrotechnica*, they discovered things such as alkaloids, flavonoids, cardiac glycosides, polyphenols, lipids, pregnanes, and triterpenoids. These substances are what give the plant its many health benefits, like acting as an antioxidant, fighting microbes and inflammation, and even showing effects against cancer-related illness, diabetes, and worms[10]. In traditional *Ayurvedic* medicine, this plant is known as a source of "*Jivanti*", a really important *Rasayana* drug that's believed to boost energy and general well-being. The fact that it's used in both cuisine and medicine suggests that it might help ward off chronic conditions like cancer, heart conditions, and liver problems. The physical characteristics of *L. pyrotechnica* are shown in Figure 1[11].

2. Taxonomic Classification

The taxonomic classification of *L. pyrotechnica* is shown in Table 1. The morphological characteristics of the plant can be observed in Figure 2. *L. pyrotechnica* is a member of the *Asclepiadaceae* family, situated within the systematic order *Gentianales*. Within its genus, *Leptadenia*, it is the only widely recognised species[12]. It is a woody climber with slender branches and heart-shaped leaves. The classification of this species has undergone revisions due to its unique features and distinct growth habits. The classification of *L. pyrotechnica* has been a subject of debate among botanists due to its distinct characteristics and ability to adapt to diverse environments[7]. In Figure 3, metabolites present in different parts of *L. pyrotechnica* are shown[13].

3. Phytochemistry

3.1 Quantitative Phytochemical Screening

3.1.1 Total Alkaloid Content

A mixture of ethanolic acetic acid and 5g of plant powder is prepared. This mixture is kept in an incubator for four hours. This mixture was then filtered and decreased to its 1/4th volume. A few drops of dilute NH_4OH were introduced into the above-prepared mixture. The precipitate which will be formed is likely to be washed, dried and weighed[14].

3.1.2 Total Tannin Content

The total tannin content in the subterranean structure and upper segments of *L. pyrotechnica* was evaluated using a tannic acid standard curve. Solutions ranging from 20 to 100 mg per mL were prepared from a 1 gram per ml stock solution in distilled water. Each 0.1 mL dilution was blended with Folin-Denis reagent and 0.5% Na_2CO_3 solution, adjusting the final volume to

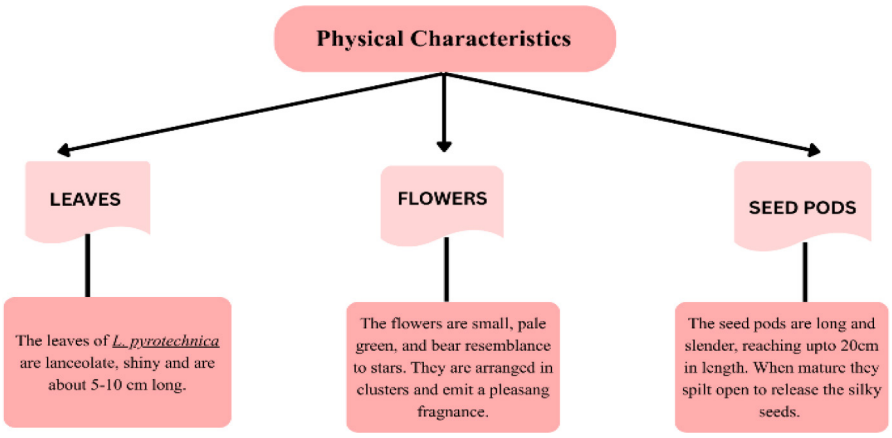


Figure 1. Physical characteristics of *L. pyrotechnica*[5,6].

Table 1. Taxonomical Classification of *L. pyrotechnica*[1-4]

Kingdom	*Plantae*
Subkingdom	*Viridaeplantae*
Phylum	*Magnoliophyta*
Subphylum	*Spermatophytina*
Class	*Magnoliopsida*
Subclass	*Lamiidae*
Order	*Gentianales*
Family	*Asclepiadaceae*
Genus	*Leptadenia*
Species	*Pyrotechnica*



Figure 2. *Leptadenia pyrotechnica.*

10 mL with water. After 20 minutes, the attenuation at 755 nm was measured photometrically compared to a blank free from tannic acid[15].

3.1.3 Total Flavonoid Content

The overall flavonoid abundance in herbal infusion was analysed employing the aluminium chloride colourimetric method; 100 mg of sample of methanolic extract from every vegetative fragment was agitated with 1 mL of deionised water. To this solution, 1.5 mL of 95% ethanol was added and thoroughly shaken. Later on, a mixture of 0.1 mL of 10% aluminium chloride hexahydrate and one mole of potassium acetate was introduced. Afterwards, 2.7 mL of deionised H_2O was incorporated. This blend was capped in the incubator for 39 minutes at 24.5°C. The absorption was measured using a spectrophotometer at 414 nm against a blank[16].

3.1.4 Total Saponin Content

To assess the overall saponin amount in both below-soil parts and airborne components of *L. pyrotechnica,* 20 grams of each granulated specimen were treated by incorporating hundred cm^3 of 20% aqueous ethanol. For four hours, this blend was then subjected to heat over a water bath at 55°C under continuous agitation. After being strained, the residue formed was rinsed

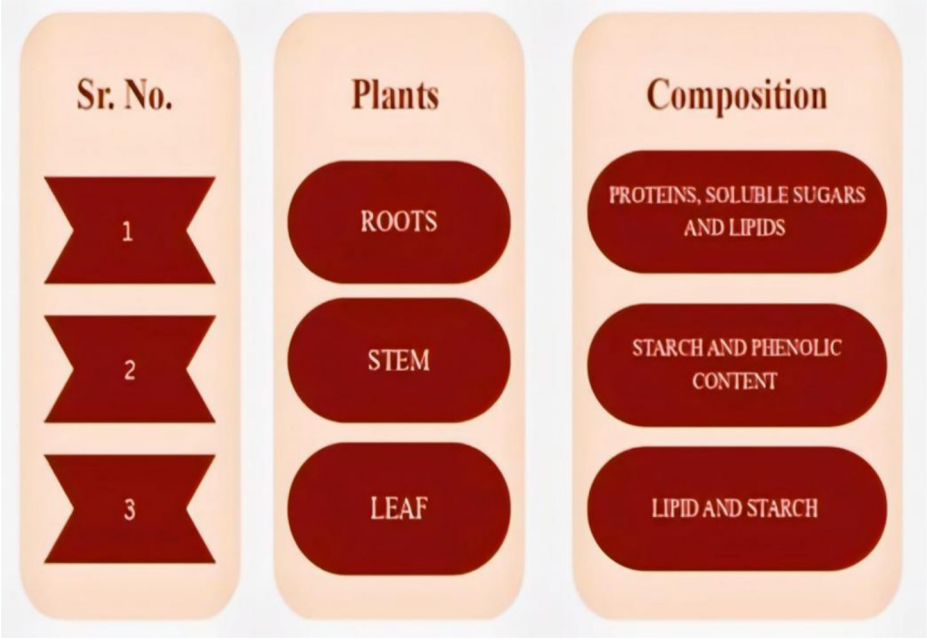
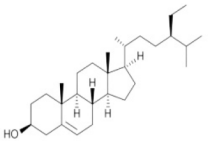
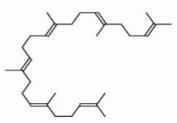
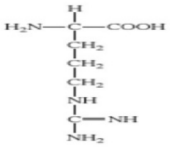
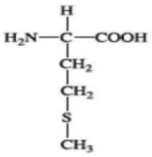
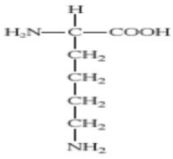
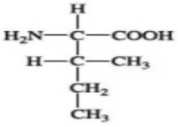
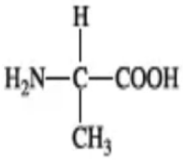
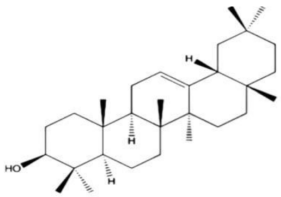
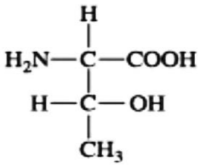


Figure 3. Metabolites present in different parts of plants[7].

Table 2. Chemical constituents of *L. pyrotechnica*[9]

Sr. No.	Chemical Name	Structure
1	Sigma sterol	
2	Squalene	
3	Arginine	
4	Metheonine	
5	Phytol	
6	Lysine	
7	Leucine	
8	Aniline	
9	B-Amyrin	
10	Threonine	

with 200 mL of 20% ethanol[17]. The combined extracts were reduced to 40 mL in hydrothermal immersion at 90 degrees Celsius and were transferred to a separating funnel. Further ethoxyethane was introduced, and the amalgamation was agitated vigilantly to remove the ether film. The aqueous layer underwent detoxification with sixty millilitres of butane-1-ol. The unified infusions were rinsed with ten millilitres of five per cent hydrous NaCl. The resulting mixture was concentrated in a pre-weighed Falcon tube over a water bath until complete dryness, and the remaining saponin content was used to analyse the percentage[18]. The chemical constituents of *L. pyrotechnica* are shown in Table 2.

4. Statistical Analysis

Regression models were built for quercetin and tannic acid to determine total flavonoid contents and total tannin contents, respectively. Total alkaloids saponin contents of each sample were determined by following formulae:

1)Total Alkaloids Content = Weight of Alkaloids / Weight of Plant Powder * 100
2) % Saponins = Weight of Saponins / Weight of Plant Powder * 100[10]

5. *Leptadenia pyrotechnica* Extract Activity

The methanol-based infusion from the above-ground components of *L. pyrotechnica* has been noted for its tumour-killing activity. Its antioxidant properties were determined through hydrogen peroxide radical scavenging and DPPH assay methods, revealing a notable correlation between free radical inhibition and extract concentration. The extract indicated cholesterol-lowering and cardiovascular impacts in rabbits subjected to a cholesterol-enriched regimen. The introduction of the methanolic extract resulted in lower cholesterol levels in the liver and aorta, oxidative degradation in lipids and triacylglycerol levels in treated rabbits[19].

The methanol extract taken from the aerial parts of *L. pyrotechnica* showed an increase in faecal cholesterol output and favourable effects on the aorta. Its anti-diabetic potential was examined against streptozotocin-induced diabetic rats, which revealed dose-dependent

lowering of blood sugar levels in the treated rodents. The ethanol-based infusion taken from the aerial parts of *L. pyrotechnica* displayed much effect in both antioxidant and anti-inflammatory activities. It was seen that the infusion notably reduced sea moss-triggered hoof oedema and exhibited positive responses in ethanol-acid-triggered inflammatory bowel disease in rodents. The Aqueous ethanolic infusion was examined further for its antioxidant, cytotoxic, and anti-lipoxygenase activities, which revealed the presence of polyphenolic compounds with antioxidant properties. A direct proportion was observed between oxidation-increasing potential and the overall alcoholic concentration of the plant extract, with the ethyl acetate portion demonstrating comparatively superior antioxidant properties[20].

Extract of *L. pyrotechnica* showcased heightened lipoxygenase inhibitory prowess. The plant's augmented cytotoxicity was attributed to its robust antioxidant properties. Antibacterial efficacy against *Staphylococcus aureus* and *Staphylococcus epidermidis* was explored using diverse solvent extracts (C_6H_{14}, $CHCL_3$, CH_3COCH_3, C_2H_6O, $C_4H_{10}O$, CH_3OH and H_2O). *S. aureus* exhibited notable susceptibility to all solvent extracts, with root extracts demonstrating a marginal superiority in inhibition. The methanolic infusion from both floral elements proved efficacious in impeding the expansion of each disease-causingmicroorganism. Furthermore, the methanol extract from the entire plant exhibited dose-dependent parasitic worm-expelling capability against *Pheretima posthuma.* In antifungal assays, n-hexane and ethyl acetate extracts displayed maximal hindrance to *Aspergillus niger*. The methanol extracts manifested significant activity against *Fusarium oxysporium* and *Aspergillus flavus*. The antibacterial assay on dichloromethane, methanol, and aqueous extracts highlighted the methanol extract's optimal germicidal impacts against *S.* aureus, *Bacillus subtilis*, and *Pseudomonas aeruginosa*. CH_2CL_2 and aqueous extracts exhibited selective inhibition[21].

6. Pharmacological Activities

6.1 Anthelmintic Activity

Within the scope of this investigation, we delved deeply into the study of the anthelmintic properties, specifically examining the vermifuge effects. The focus was on two distinct concentrations, 50 and 100 mg/mL, which were derived from the methanolic extract of the entire plant. The objective was to comprehensively understand and evaluate the impact of these concentrations on combating parasitic worms. Our central emphasis revolved around evaluating their effectiveness against *P. posthuma*, where Albendazole (20 mg/mL) served as the standard benchmark, and Carboxymethyl cellulose (CMC) (0.5%) was utilised as the control substance. The primary objective was to gauge how well these concentrations performed compared to the established reference and control in combating the targeted organism. In our pursuit to assess the influence, we quantified the duration of incapacitation and the time of death in the worms. Significantly, our results unveiled a noteworthy anthelmintic potential in the examined extract, particularly at higher concentrations (100 mg/mL), surpassing the efficacy of the established reference medication. These outcomes underscore the auspicious therapeutic qualities of the plant extract, unveiling novel avenues for further exploration in the domain of anthelmintic research[22].

6.2 Antidiarrheal Activity

In a research endeavour conducted in Nigeria, our focus revolved around scrutinising the aqueous ethanolic extract (80.20% v/v) obtained from the upper plant sections, along with its deoiled variant. The experimentation involved the induction of diarrhoea through castor oil, with oxylate HCl serving as the standardised reference pharmaceutical at a dosage of 5 mg/kg. This study aimed to thoroughly appraise the potentialalleviatingimpactondiarrhoeaofthese extracts relative to the established reference medication within the specified parameters of the experimental setup. The outcomes suggested that the oral administration of the examined compound significantly restrained the frequency of bowel movements in treated rats as opposed to the control groups. Notably, the deoiled derivative exhibited its utmost effectiveness at the 1200 mg/kg dose, highlighting its potential as a prospective agent for managing diarrhoea[23].

6.3 Anti-inflammatory Activity

We investigated the potential anti-inflammatory properties of the ethanolic extract sourced from the upper plant portions in male Wistar albino rats.

The evaluation involved determining the percentage inhibition of paw swelling through the carrageenan-induced paw oedema test. The administered doses were 200 and 400 mg/kg, with dexamethasone employed as the standard reference at a dosage of 0.2 mg/kg. The findings revealed a discernible decrease in both inflammatory response and swelling, showcasing a significant 50.60% reduction in paw enlargement three hours after the administration of carrageenan at a dosage of 400 mg/kg. Furthermore, the study delved into the exploration of lipoxygenase-inhibitory potential within the ethanolic extract and its segmented fractions, specifically ethyl acetate[24].

6.4 Antibacterial Activity

The antibacterial efficacy of *L. pyrotechnica* was scrutinised by formulating methanolic, aqueous, and dichloromethane extracts encompassing the entire plant. This study was designed to evaluate the effectiveness of these extracts in combating bacterial activity, providing insights into the plant's potential antibacterial properties[25]. *In vitro* investigations were carried out to assess the efficacy against *S. aureus*, *B. subtilis*, *E. coli*, *P. aeruginosa*, and *M. flavus*. This evaluation employed remote diffusion and DPPH methodologies, offering insights into the potential activity of the tested substances against a diverse range of bacteria. Remarkably, the 10% and 50% concentrations demonstrated significant antibacterial efficacy, particularly evident in cellular models simulating human epithelial tissues. Furthermore, these same concentrations exhibited commendable results against FL cells, emphasising the potential of *L. pyrotechnica* extracts as promising antibacterial agents with notable effects on various bacterial strains[26].

6.5 Anticancer Activity

The exploration of the anticancer properties of the plant extract in ethyl acetate yielded promising findings. This investigation uncovered encouraging outcomes indicative of the extract's potential in combating cancer[27]. The investigation unveiled substantial antitumor potency of the plant extract against the MCF-7 human mammary carcinoma cell line[28]. This indicates a notable ability of the extract to inhibit the growth of cancer cells, particularly those associated with human mammary carcinoma[29]. The findings underscore the potential therapeutic relevance of the plant extract in addressing this specific type of cancer. These results emphasise the promise of the ethyl acetate extract as a prospect for additional investigation in the advancement of antineoplastic therapies, especially in the context of addressing human mammary carcinoma[30]. This suggests that further exploration of the extract could contribute valuable insights towards the development of cancer treatments, particularly tailored for human breast cancer[31].

7. Traditional Uses

Leptadenia pyrotechnica has conventionally been employed for diverse objectives. A concoction crafted from the stem of *L. pyrotechnica* is consumed for its antiallergic attributes and as a respiratory secretion facilitator[32]. In the Indian context, it finds application in addressing issues related to gout and rheumatism. In certain locales, the stems are applied to wounds to arrest bleeding[33]. A brew crafted from the upper portions is imbibed as a diuretic remedy for the alleviation of kidney ailments. The branches undergo a thorough extraction process, and the resultant solution is consumed for the mitigation of urinary retention. A fusion of the entire botanical specimen, harmonised with cultured butter extract, is administered to counteract uterine prolapse and gastric disturbances[34]. All constituents of *L. pyotechnica* are incorporated in indigenous therapeutics to alleviate conditions associated with the integumentary system, musculoskeletal structure, and gynaecological irregularities[35]. The fumes arising from the combusted vegetation are applied for the alleviation of cephalalgia and rheumatological discomfort. The vegetal sap, extracted with precision, finds application as a topical remedy for mitigating afflictions such as minor pox, psoriasis, eczema, and dermatitis[36]. Simultaneously, the aqueous essence obtained from the leaves, steeped in tradition, is administered to ameliorate respiratory distress, alleviate rheumatism, and assuage instances of infantile diarrhoea[37]. To alleviate thorn-induced injuries, a foliage concoction is meticulously crafted and administered to the affected area. The infusion crafted from the fruits and stem is employed for the management of ear discomfort and persistent renal issues. Additionally, it serves as a digestive aid and promotes the elimination of waste.

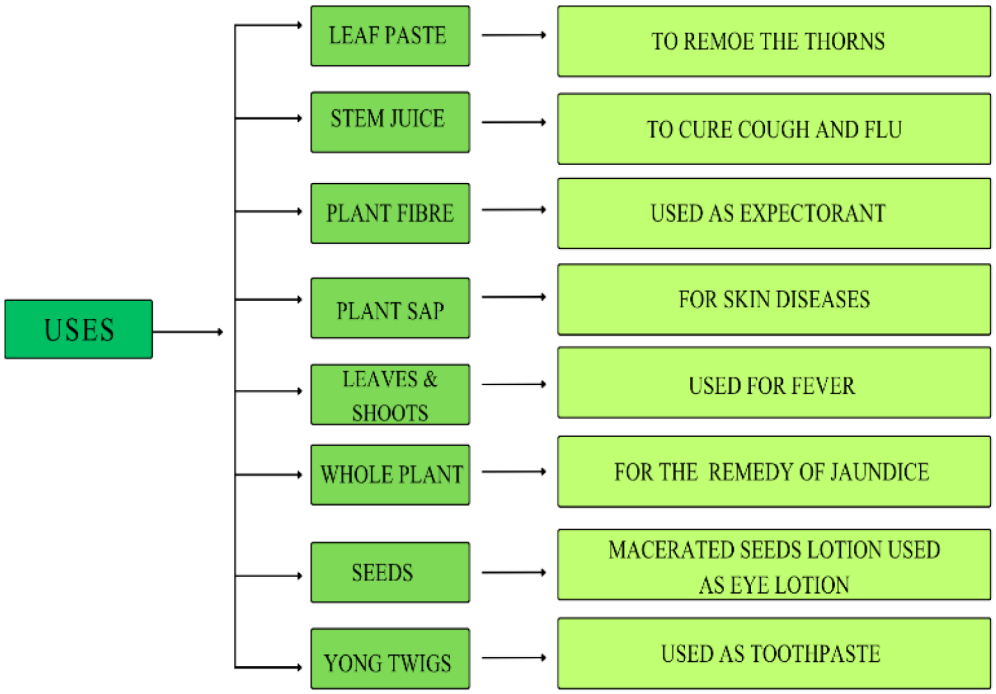


Figure 4. Different traditional uses of *L. pyrotechnica*[12].

The hidden portions of this plant play a crucial role in addressing various health concerns. Specifically, they are employed to alleviate conditions associated with breathing difficulties, facilitate bowel regularity, and mitigate issues related to digestion[38-43]. The subterranean components of the plant are harnessed for a multifaceted therapeutic approach. They are utilised to address concerns related to infertility, playing a role in treatments aimed at promoting fertility. Furthermore, these roots are employed as a preventive measure against spontaneous abortion, contributing to reproductive health. Additionally, their diuretic properties are harnessed to assist in the management of venereal diseases. Subterranean bark, blended with milk from cattle, is administered as a substance promoting intestinal cleansing[44]. The vegetation is utilised in gastronomy as a vegetable option, and the fibrous segment of the plant finds application in the fabrication of durable ropes[45]. The botanical entity is employed in constructing roofs for dwellings, utilising a thatching technique. Additionally, the immature pods of the shrub, maturing within the month of March, are also utilised as a culinary green. The plant is recognised for its qualities as a nourishing fodder, with a specific emphasis on its ability to meet the dietary requirements essential for sustaining camels. This acknowledgement underscores its significance in providing a well-rounded and beneficial dietary component for these animals. Within the geographical confines of Saudi Arabia, a medicinal infusion is meticulously concocted from the seeds and the entire plant. This infusion serves a multifaceted purpose, proving effective in the treatment of influenza, conditions associated with lectogauge, and respiratory afflictions marked by coughing or tussive symptoms. The nuanced utilisation of this botanical remedy reflects its versatility in addressing various facets of respiratory health within the cultural context of Saudi Arabia. To counteract ringworm, the plant's aqueous essence, rich in healing properties, is effectively applied[46].

Amidst the vast Nara Desert, the tender clusters of this flora play a pivotal role in the meticulous art of crafting durable ropes, showcasing the resourcefulness of nature in diverse applications. In the landscapes of Senegal, this botanical specimen plays a crucial role as a natural laxative, offering relief from gastrointestinal concerns, alongside its efficacy in mitigating muscle and renal discomfort. The sap extracted from the plant is meticulously utilised for its therapeutic properties, particularly in the treatment of diverse skin ailments, showcasing its versatility in dermatological applications. Furthermore, the plant's stem, distinguished by its

diuretic prowess, serves a pivotal role in promoting the expulsion of kidney stones, contributing to renal health. The boiled filtrate derived from the plant, when administered twice daily, holds promise as an adjunct in the management of tuberculosis, underscoring the multifaceted medicinal attributes of this botanical resource[47-49]. The different traditional uses of *L. pyrotechnica* are shown in Figure 4.

8. Conclusion

Various plants have different medicinal uses. There are numerous plants in the world which contribute to the medicinal field in various ways. *L. pyrotechnica* is one such plant which has many uses, traditionally as well as medicinally. As concluded from the studies, we can say that *L. pyrotechnica* shows many activities such as antidiabetic, anti-inflammatory, anti-cancer, and antibacterial. With such properties, *L. pyrotechnica* will prove to be one of the most beneficial medicinal plants. If studied properly and keenly, many formulations can be prepared with the help of this plant. *L. pyrotechnica* contain Flavonoids, tannins, saponins, and alkaloids. This enhances the properties of the plant. The traditional side of *L. pyrotechnica* also provides us with many benefits. In many rural areas, this plant is useful in home remedies. As an expectorant and diuretic agent, for treating mild headaches, and urinary retention can also be treated with the help of its macerated liquid. Many people have used this plant from ancient times as an easy source of relief. With so many benefits and wonderful results, *L. pyrotechnica* also gives us many opportunities for further exploration and inventions which can be very much beneficial for the human race. Being a rare plant, it opens many ways for us to discover and take out much for the future.

9. Acknowledgement

The authors are thankful to the School of Pharmacy, Vishwakarma University, Pune, for providing all necessary technical support.

10. References

1. Donia AMR, Soliman GAH, El-Sakhawy MAE, Yusufoglu H, Zaghloul AM. Cytotoxic and antimicrobial activities of *Emex spinosa* (L.) Campd. extract. Pak J Pharm Sci. 2014; 27(2):351-356.
2. Idrees S, Qureshi R, Bibi Y, *et al*. Ethnobotanical and biological activities of *Leptadenia pyrotechnica*: a review. Afr J Tradit Complement Altern Med. 2016; 13(4):88–96. https://doi.org/10.21010/ajtcam.v13i4.13 PMid: 28852724 PMCid: PMC5566157.
3. Mohanty SK, Swamy MK, Sinniah UR, Anuradha M. *Leptadenia reticulata* (Jivanti): review. Molecules. 2017; 22(6):1019. https://doi.org/10.3390/molecules22061019 PMid: 28629185 PMCid: PMC6152761.
4. Shah GM, Jamal ZA, Hussain M. Phytotherapy among rural women. Pak J Bot. 2013; 45:253–261.
5. Amuthan A, Chogtu B, Bairy KL, Prakash M. Evaluation of diuretic activity. J Ethnopharmacol. 2012; 140(2):424–427. https://doi.org/10.1016/j.jep.2012.01.049 PMid: 22331031.
6. Grover JK, Yadav S, Vats V. Medicinal plants with antidiabetic potential. J Ethnopharmacol. 2002; 81(1):81–100. https://doi.org/10.1016/S0378-8741(02)00059-4 PMid: 12020931.
7. Abd El-Ghani MM, Amer WM. Soil–vegetation relationships. J Arid Environ. 2003; 55(4):607–628. https://doi.org/10.1016/S0140-1963(02)00318-X
8. Ahmed N, Mahmood A, Mahmood A, *et al*. Indigenous medicinal plants study. J Ethnopharmacol. 2014; 155(1):509–523. https://doi.org/10.1016/j.jep.2014.05.052 PMid: 24942673.
9. Fahal EM, Rani BM, Aklakur MD, *et al*. Phytochemical analysis of *Moringa oleifera*. Int J Curr Microbiol Appl Sci. 2018; 7(5):657–665. https://doi.org/10.20546/ijcmas.2018.705.080
10. Munazir M, Qureshi R, Munir M. Phytochemical screening of *Leptadenia pyrotechnica*. Pak J Bot. 2015; 47(2):659–664.
11. Moustafa AM, Khodair AI, Saleh MA. Phytochemical investigation. J Pharmacol Toxicol. 2007; 2:681–697. https://doi.org/10.3923/jpt.2007.681.697
12. Al-Fatimi M, Wurster M, Schröder G, Lindequist U. Antioxidant and antimicrobial activities. J Ethnopharmacol. 2007; 111(3):657–666. https://doi.org/10.1016/j.jep.2007.01.018 PMid: 17306942.
13. Ravishankar B, Shukla VJ. Indian systems of medicine. Afr J Tradit Complement Altern Med. 2007; 4(3):319–337. https://doi.org/10.4314/ajtcam.v4i3.31226 PMid: 20161896 PMCid: PMC2816487.
14. Ameyaw Y, Duker-Eshun G. Alkaloid content study. Int J Chem Sci. 2009; 7(1):48–58.
15. Shah K, Krishna G. Pharmacological evaluation. Iraqi J Pharm Sci. 2023; 32(3):49–59. https://doi.org/10.31351/vol32iss3pp49-59
16. Javid S, Chaudhari SK, Munir I, *et al*. Plant metabolites study. In: Natural Bio-active Compounds. 2019; pp. 551–560. https://doi.org/10.1007/978-981-13-7154-7_19
17. Ali MS, Kausar F, Malik A. Pyrotechnoic acid study. J Chem Soc Pak. 2001; 23(3):180–181.
18. Sani I. Phytochemical screening. Appl Sci Rep. 2016; 14(3):273–277.

19. Aliero AA, Wara SH. Medicinal potential study. Afr J Pharm Pharmacol. 2009; 3(6):335–338.
20. Soliman GA, Donia AE, Awaad AS, *et al.* Reproductive effects study. Pharm Biol. 2012; 50(1):105–112. https://doi.org/10.3109/13880209.2011.601465 PMid: 22196585.
21. Ullah R, Alsaid MS, Alqahtani AS, *et al.* Anti-inflammatory activity. Open Chem. 2019; 17(1):1034–1042. https://doi.org/10.1515/chem-2019-0113
22. Youssef MA, Khodair AI, Saleh MA. GC-MS investigation. Pharm Biol. 2009; 47(10):994–1003. https://doi.org/10.1080/13880200902973761
23. Abe F, Yamauchi T, Honda K, *et al.* Alkaloid sequestration. Phytochemistry. 2001; 56(7):697–701. https://doi.org/10.1016/S0031-9422(00)00445-3 PMid: 11314955.
24. Rahman MA, Ahmed NU. Biological activities. Bangladesh J Sci Ind Res. 2013; 48(1):43–50. https://doi.org/10.3329/bjsir.v48i1.15413
25. Bayala B, Maria H, Ouédraogo A, *et al.* Biomedical applications. Am J Drug Discov Dev. 2018; 8:1–10.
26. Verma N, Jha KK, Chaudhary S, *et al.* Pharmacology review. Indian J Pharm Biol Res. 2014; 2(1):128. https://doi.org/10.30750/ijpbr.2.1.20
27. Atanasov AG, Waltenberger B, Pferschy-Wenzig EM, *et al.* Natural products review. Biotechnol Adv. 2015; 33(8):1582–1614. https://doi.org/10.1016/j.biotechadv.2015.08.001 PMid: 26281720.
28. Ekor M. Herbal medicine safety. Front Pharmacol. 2014; 4:177. https://doi.org/10.3389/fphar.2013.00177 PMid: 24454289 PMCid: PMC3887317.
29. Jamshaid M, Rashid U, Butt ZA, *et al.* Phytochemical analysis. Open Access Res J Biol Pharm. 2022; 6(1):81–88.
30. Uzodimma D. Ethnobotanical inventory. Glob Adv Res J Med Plants. 2013; 2:30–44.
31. Badamasi MZ, Adamu T, Abubakar U, *et al.* Antimalarial activity. Niger J Parasitol. 2011; 32(2).
32. Partap S, Tewari U, Sharma K, Jha KK. Antioxidant activity. J Drug Deliv Ther. 2014; 4(1):40–44. https://doi.org/10.22270/jddt.v4i1.742
33. Chaulya NC, Haldar PK, Mukherjee A. Antidiabetic activity. Acta Pol Pharm. 2011; 68(6):989–992.
34. Putri DA, Ulfi A, Purnomo AS, *et al.* Antioxidant study. Malays J Fundam Appl Sci. 2018; 14(2):307–311.
35. Alqasoumi SI, Soliman GA, Awaad AS, *et al.* Anti-inflammatory study. Phytopharmacology. 2012; 2(1):58–71.
36. Ullah F, Uzair M, Chaudhry BA, *et al.* Pharmacological studies. Pak J Pharm Res. 2015; 1(2):78–85. https://doi.org/10.22200/pjpr.2015278-85
37. Singh H, Bhushan S, Arora R, *et al.* Neuropathic pain review. Biomed Pharmacother. 2017; 92:634–650. https://doi.org/10.1016/j.biopha.2017.05.079 PMid: 28578258.
38. Glew RS, VanderJagt DJ, Bosse R, *et al.* Nutrient content study. J Food Compost Anal. 2005; 18(1):15–27. https://doi.org/10.1016/j.jfca.2003.12.002
39. Preet R, Gupta RC, Pradhan SK. Chromatographic determination. J Planar Chromatogr. 2018; 31(2):150–154. https://doi.org/10.1556/1006.2018.31.2.9
40. Suthar R, Kumar D, Garg A, *et al.* Diuretic activity. World J Biol Pharm Health Sci. 2022; 11(3):13–17.
41. Chaudhary S, Khosa RL, Jha KK, Kumar S. Antidiabetic study. Pharmacol Online. 2011; 2:1196–1204.
42. Cioffi G, Sanogo R, Vassallo A, *et al.* Pregnane glycosides. J Nat Prod. 2006; 69(4):625–635. https://doi.org/10.1021/np050493r PMid: 16643040.
43. Gandhi DM, Kapadia NS, Shah SK, *et al.* Pharmacognostical study. J Nat Remedies. 2012; 12(1):77–86.
44. Khasawneh MA, Elwy HM, Hamza AA, *et al.* Cytotoxic activity. Molecules. 2011; 16(9):7510–7521. https://doi.org/10.3390/molecules16097510 PMid: 21894086 PMCid: PMC6264363.
45. Conforti F, Sosa S, Marrelli M, *et al.* Anti-inflammatory activity. J Ethnopharmacol. 2008; 116(1):144–151. https://doi.org/10.1016/j.jep.2007.11.015 PMid: 18164564.
46. Hammiche V, Maiza K. Traditional medicine. J Ethnopharmacol. 2006; 105(3):358–367. https://doi.org/10.1016/j.jep.2005.11.028 PMid: 16414225.
47. Upadhyay B, Singh KP, Kumar A. Ethnoveterinary uses. J Ethnopharmacol. 2011; 133(1):14–25. https://doi.org/10.1016/j.jep.2010.08.054 PMid: 20817085.
48. Osman HM, Shayoub ME, Babiker EM. Blood parameter study. Jordan J Biol Sci. 2012; 5(3):147–150.
49. El-Fitiany RA, Khasawneh MA. Comprehensive review. Food Rev Int. 2023; 39(9):6834–6886. https://doi.org/10.1080/87559129.2022.2126853

Author Contribution

Conceptualisation: Mamta Chaudhary; Formal analysis: Mamta Chaudhary, Snehal Pardeshi, Arpita Rai, Kanchan Chaudhary, Poonam Tiwari; Resources: Poonam Tiwari, Arpita Rai; Data curation: Snehal Pardeshi, Kanchan Chaudhary; Writing - Original draft preparation: Mamta Chaudhary, Snehal Pardeshi, Arpita Rai, Kanchan Chaudhary, Poonam Tiwari; Writing - review and editing: Yogita Shinde, Rakesh Choudhari; Visualisation: Mamta Chaudhary, Snehal Pardeshi, Arpita Rai, Kanchan Chaudhary, Poonam Tiwari; Final Approval: All authors have read and agreed to the published version of the manuscript.

