



Landscapes of healing: Exploring health care provisions and medicinal plant diversity in the Nalanda hinterland

Sharmistha Chatterjee¹ · Snehadip Saha²

Received: 27 November 2024 / Accepted: 1 August 2025 / Published online: 21 August 2025
© Indian National Science Academy 2025

Abstract

Nalanda, the monastic cum scholastic establishment, is known for higher learning with a unique blend of spirituality, academia, and holistic healthcare. The paper delves into the healthcare provisions and medicinal plant diversity in the ancient monastic complex of Nalanda and its hinterland, situating its significance within the region's cultural and geographical context. The paper further explores the strategic location of the Mahāvihāra and its connection with the Rajgir hills. Drawing from the colonial reports and Buddhist Pāli texts, this study deciphers the region's rich diversity and use of medicinal plants. Further, it examines healthcare provisions in the context of monastic establishments, underscoring the pivotal role of the monastic organizations, particularly Nalanda, in fostering spiritual and academic growth.

Keywords Nalanda Mahāvihāra · Health care · Medicinal plants · Landscapes of healing

1 Introduction

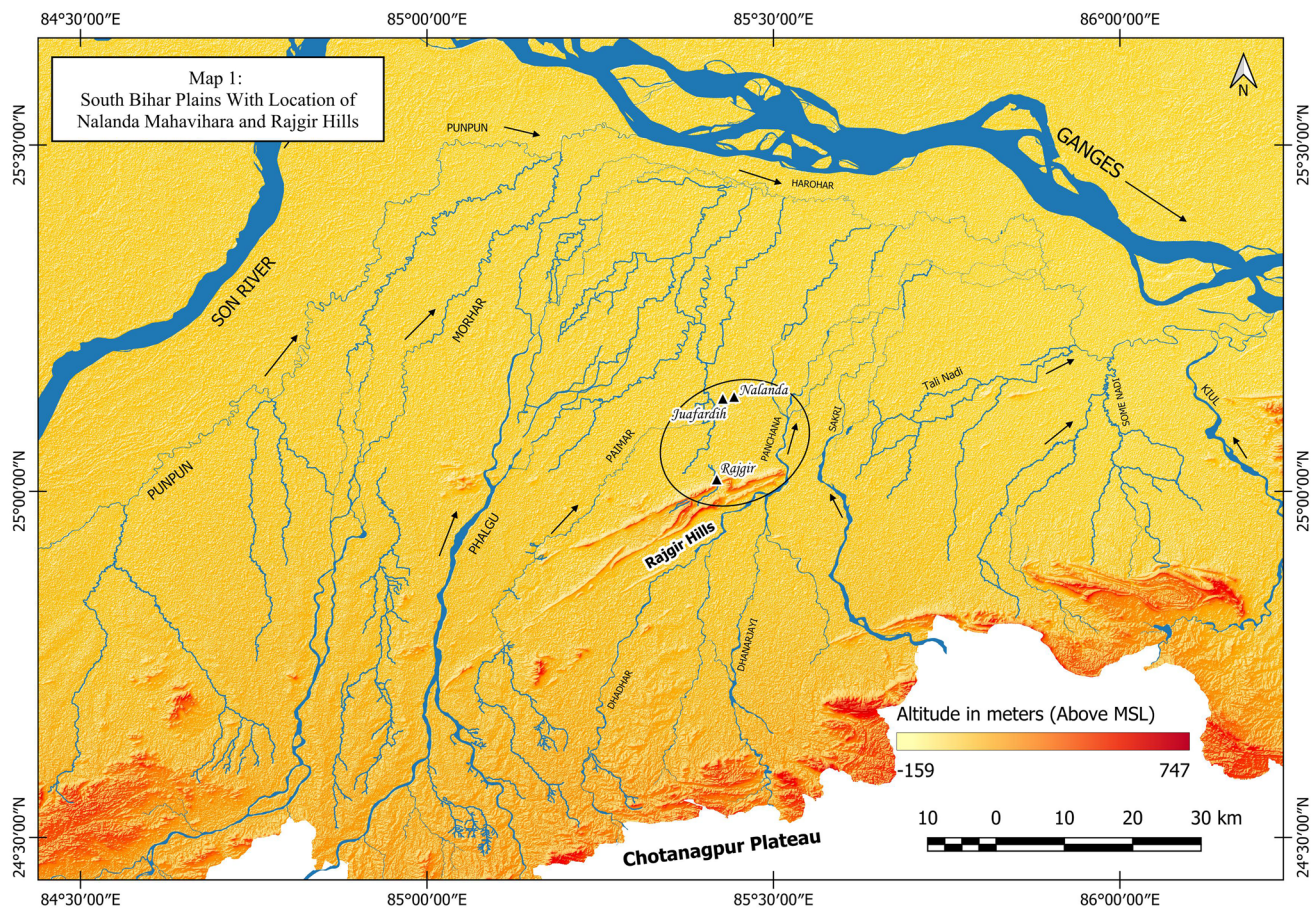
Embracing the principles of interdependence and compassion, Buddhism fosters a deep appreciation for the environment and all living beings, inspiring a harmonious coexistence that promotes ecological balance and well-being. These beliefs and practices encourage individuals to be accountable for their actions and recognize their profound impact on the world around them. With the belief systems and the moral order based on *pratītyasamutpāda* (law of dependent origination), Buddhism promotes harmony between the physical and metaphysical realms, emphasizing compassion, interconnectedness, and oneness with the natural world, fostering a profound sense of unity and balance within the universe. Buddhism's holistic vision weaves together the well-being of humans, animals, plants, and the planet, guiding us towards sustainable living. In Buddhist eschatology,

the degradation of the world is seen to be due to the moral degradation of people and their frivolous attitude toward their responsibilities to the world (Dorzhigushaeva & Kiplyuks, 2020). Further, the Buddhist moral ideas sow the seeds of anthropocentric-teleological concerns. They consider the destruction of natural resources as unethical and encourage sustainable human existence through a symmetrical ecosystem (Singh, 2010). The wide circulation and preaching of these philosophies could be seen metamorphosing into an academic order to be observed and practiced in the monastic complexes associated with Buddhism. The Nalanda monastic cum scholastic establishment in the south Gangetic plains of Bihar stands as the best testimony to a disciplined academic ambience of higher learning and spiritual growth. This paper explores the symbiotic relationship between the natural environment and the Buddhist architectural complex at Nalanda, highlighting its impact on monastic life. Through an archaeological reconstruction of the region, this study examines the interplay between natural topography and the monastic complex, revealing Nalanda's emergence as an epicenter of scholarly learning and practice.

✉ Sharmistha Chatterjee
sharmistha.history123@gmail.com
Snehadip Saha
snehadip96s@gmail.com

¹ Department of History, Srikrishna College, University of Kalyani, Nadia, Bagula, India

² Former Reserach Fellow in INSA sponsored History of Science Project, New Delhi, India



Map. 1 South Bihar plains with location of Nalanda Mahāvihāra and Rajgir hills

2 Understanding the region and its archaeological importance

Nalanda Mahāvihāra was reputed to have functioned as one of the major centres of Buddhist learning and higher education in ancient times. Nalanda Mahāvihāra, strategically located in the south Bihar plains, stands in the protected zone between the drought-prone and the flood-affected areas with all essential resources for the sustenance of the monastic complex (Map. 1). The region is drained by the non-perennial rivers, namely the Panchane and Paimar that have left their imprints in the form of cut-off channels and paleochannels, evidently influencing the immediate environment and forming major sources of water during the heydays of Nalanda. Other than the rivers, the region is well guarded by the hilly ridges of Rajgir and Giriak, forming an ideal setting for a secluded, yet well-connected landscape. The forests along the hilly terrains of Rajgir form an essential part of the natural reserves, which were not only used for wood, fodder, and other essentials but also distinguished as having reserves of a plethora of medicinal plants (Jha, 2011). The site of Rajgir is one of

the foremost sites where the monastic complex of Nalanda was undeniably linked for regular exchanges and networking. Rajgir or Rājagrha was the first Magadhan capital; Rājagrha had established itself as an important city for primarily being a major centre of early urbanisation that served as the initial capital of the Magadhan plains. Early Buddhist literature suggests that the city was already well-known in the pre-Buddhist era (Jha, 2011). Different localities within the ancient capital of Rājagrha were meticulously excavated through the years, pushing back the hills' antiquity to the Palaeolithic period. Given the hilly ridges with ideal location for stone quarrying, the palaeolithic antiquity of the site is quite admissible.¹ The excavations by the Archaeological Survey of India (ASI) at Giriak (Ghorakatora mound) have revealed neolithic-chalcolithic implements with polished stone celts and bone points (Jha, 2011). A significant number of palaeobotanical evidence is available from sites like Ghorakatora and Juafardih, which

¹ Indian Archaeology-A Review Report- IAR 1953–54:9, IAR 1957–58: 11, IAR 1954–55: 16, IAR 1958–59: 12, IAR 1961–62: 7–8, IAR 1962–63: 4–5.



evidently points towards early agricultural practices and the emergence of a supportive hinterland of the Mahāvihāra complex (Jha, 2011).

The distance between Nalanda and Rajgir is around 10–12 km, as the crow flies. Rajgir is also connected with the major trade routes stretching across the upper and the lower Gangetic plains and connects the major historical sites of Pataliputra and Gaya. Singh claims that Rājagṛha being guarded by the hilly ridges could not have developed and sustained independently with all the daily essentials; Bimbisāra understanding this problem developed Nalanda as a satellite city to serve the daily necessities of the first capital of Magadha (Singh, 2024). In this regard, the Jain text *Sūtrakṛtāṅga* mentions Nalanda as *bāhrikā* (outer) in the north-east direction of Rājagṛha in the sixth century BCE where Mahāvīra spent fourteen *chāturmāsa* or rainy seasons. Likewise, *Sūyaṅgāṅgasūtra* mentions Nalanda as a prosperous and populous town. It was situated on the outskirts of Rājagṛha. He cites the observations of Hirananda Sastri that the Jain literature *Pūrvadēsacaityaparipāṭi* and the *Samēta-sikhara Tīrthamālā*, the works of the sixteenth century mentioned Nalanda as being in the suburb region of Rājagṛha where Mahāvīra spent fourteen rainy seasons (Singh, 2024). Therefore, from this textual evidence, it can be surmised that Nalanda and Rajgir share close ties. In the early historic period, a well-developed hinterland with agricultural supplies supported the emergence and expansion of Rājagṛha, the first capital of Magadha, as a flourishing site of the historical times, following which the same capital served as a significant resource base for the Nalanda Mahāvihāra in the early medieval period—with supplies of resources like wood, fodder, minerals, medicinal plants, forest products the networking between the two sites flourished till the medieval period. The ruins of these structural complexes and the ancient material vestiges at both sites were discovered during the field surveys undertaken by the British surveyors. In the days of colonial expansion and consolidation in the Indian subcontinent, British administrators made continuous endeavours to undertake surveys and documentation of historical sites, uncharted territories, and biogeographic resources across India. These records facilitated the British administrators in drafting the expansionist strategies along with documentation of the flora, fauna, and different kinds of organic–inorganic resources available within the subcontinent.

3 Previous research—contributions of Francis Buchanan

Amidst the impressive list of natural historians employed by the British East India Company, the name of Francis Buchanan (1762–1829) stands out, for the many years he

spent on major surveys to far-flung corners of the Indian subcontinent, and the huge volume of information that he gathered, recorded, and documented on a bewildering variety of subjects (Watson & Noltie, 2016). Buchanan was part of the Company's 'massive intellectual campaign to transform a land of incomprehensible spectacle into an empire of knowledge', and was one of those 'at the forefront of this campaign who mapped the landscape and studied the inhabitants, who collected geological and botanical specimens, and who recorded details of economy, society, and culture'—indeed he was one of the first to lay down these methods (Edney, Mathew quoted in Watson & Noltie, 2016).

Buchanan was a polymath; he traveled extensively in eastern and southern India and was highly motivated and trained because of his earlier associations with the Botanic Garden in Edinburgh, Jardin Des Plantes in Paris. His expertise helped gather good knowledge of the different classificatory systems used in the documentation of flora and fauna. Buchanan is widely acknowledged and appreciated for his knowledge and the wide range of information he had gathered on history, geography, climate, topography, agriculture, economy, society, religion, health conditions, and the larger demographic picture of the region he was surveying. Buchanan is also widely known for his writings on the ancient ruins of eastern and southern India. His pioneering records played a crucial role in reviving Buddhism in the Indian subcontinent. His meticulous notes on Burma, Bihar, and Bengal serve as a rich repository, with his writings on Nalanda and Rajgir being especially instrumental in shedding light on these historical sites of south Bihar. A large part of his writings and manuscripts are now housed in the British Museum (India Office Records) and the Royal Asiatic Society of Great Britain and Ireland in London (Buchanan, 1814; Jackson, 1925).

During his surveys in Bihar, Buchanan elaborately recorded the historical ruins associated with Buddhism. His survey reports on the regions of Gaya, Patna, and Rajgir, highlighted the abundance of medicinal plants in the region. Buchanan mentions that, given the number of abundant plants, the ones to be processed as medicines are subject to disquisitions, which should be strictly scientific. He refers to the abundant collection without going into length on the description of the different species. He clearly wrote that the amount and extensive collection of medicinal plants in the region deserves the government's immediate attention. He goes on to discuss how the native physicians used these extensive collections of medicinal plants. He elaborates on the three sects of the native physicians, *i.e.* the Yunani (Ionians) among the Muhammedans, the Śākadvīpi Brāhmaṇas in Behar, and the Baidyas in Bengal. Along with medicinal plants, mineral resources are also abundant in the region, some of which were used in the preparation of medicinal plants. Of these accounts, the mention of Uruya, the hill



cluster in the south-western part of Rājagrha, deserves a mention. He mentions the geological formations, topographic details, names of the rivers, and specifically the outcrops of red and granular jasper along with the outcrops of siliceous hornstone. These outcrops were in the vicinity of the Tapoban hot springs at Rājagrha/Rajgir. In the Hangriyo locality of Rājagrha, Buchanan noted the natural outcrops of Silājit with a wide opening, approximately 50–60 m in diameter, 10–12 feet high, and mostly lofty. He observed that the exudations of Silājit could only be accessed by an old man of the Musahar tribe. A major part of Silājit found in the Rajgir caves was used in the making of medicines, and these were owned and sent to the local king, Ray Khosal Singha of Patna. Silājit was a valuable medicine for the people (Buchanan, 1814; Jackson, 1925).

This detailed record of Buchanan was mentioned in later works, especially the work on the Flora of Rajgir by S.R. Paul, where a detailed list of medicinal plants was provided. This report mentions around 399 vascular plants in the Rajgir hills and discusses each of these species. The names of the plants discussed by Paul (1981, Table 1) were largely based on his personal surveys and the collective works of the National Botanic Gardens (Lucknow) and the Central Drug Research Institute (CDRI). The names of the plant species found in the reports of Buchanan (1814) and Paul (1981) were further clarified with the Pāli texts in the encyclopaedic collection on the natural environment associated with early Buddhism by Dhammika (2015). Dhammika systematically categorises the collection of the plants mentioned in the Pāli texts with particulars on the local names of plants and their specific usage according to the Pāli texts (Table 1). Following the reports of Buchanan (1814), Paul (1981), and Dhammika (2015), a detailed list of the plants found in the Rajgir hills with their specimen names and their medicinal properties have been outlined in the ensuing pages.

4 Textual sources on the monastic order, healthcare, and medicinal plants

With this enumeration of the medicinal plants, one may wonder how the medicines were processed or extracted from the plants. In this connection, we have insights from the Buddhist texts like Mahāvagga, cited by Zysk (1991), to state that the sick monks needed the extracts (*kasāva*) as medicines. The Buddha allowed the following medicinal extracts to be made from the Indian lilac or neem tree (*nimba*), from the kurchi tree (*kutaja*), from the *pakkava*, and from the Indian beech (*naktamāla*). Likewise, monks were permitted to extract any extract that did not serve as solid or soft food. The extracts could be stored indefinitely (Zysk, 1991). The process of making these extracts from

the plants, fruits, roots, and leaves of the plants was a regular phenomenon; other than the Buddhist texts, these extracts and concoctions are also mentioned in the *Caraka Samhitā*. In the process of preparing the medicines, large and small stone containers were used. According to Buddhaghosa, one stone was large, and the other small (Buddhaghosa's Samantapāsādikā cited in Zysk, 1991). The roots were probably placed in a depression in the larger stone or on top of its flat surface and crushed and pounded into a powder or a pap with the smaller (Zysk, 1991). Singh draws our attention to Āyurveda in this instance where it is suggested that all the ingredients of the herbs were dried, powdered separately, and mixed as per the prescribed method recommended in the medical treatises. *Ārista* and *Āsava* are self-generated herbal fermentations used as medicines in Āyurveda (Singh, 2024). They are fermented medicaments prepared by allowing the herbal juices or their decoctions to endure fermentation. *Ārista* is made with decoctions of herbs in boiling water while *āsava* is made with fresh herbal extracts. The process of preparation of *āsava* and *āristas* is known as *Sādhanakalpanā* as mentioned in the Āyurveda, which is usually based on the infiltration and decoction of herbs. In the process of decoction, the crude herb is boiled in a special volume of water at a specific temperature for a definite time. Then it is cooled and strained for medicinal purposes (Singh, 2024). The chebulic myrobalan was one of the plants extensively used in the Buddhist monastic complexes of the region, along with beleric and *Terminalia bellirica* (Gaertn. Roxb. and embolic myrobalan (*Phyllanthus emblica* L.) as *triphalā* (Singh, 2024; Zysk, 1991).

With the gradual expansion and evolution of the monastic networks and Buddhist practices, there were additions and interpolations to the texts, *sutras*, and *dharanīs*, which led medical knowledge to be standardized and codified by the middle of the seventh century C.E. This holistic perspective of harmonious wellbeing and healing was getting preserved in the classical medical treatises and was established in the curriculum as one of the five sciences taught in Buddhist monastic universities. The courses studied at Nalanda were the works of Mahāyāna and of the eighteen Buddhist schools and other works, including the Veda, logic, grammar and philology, medicine, Atharvavedic magic, *Samkhya*, and several miscellaneous texts. The three beginning with logic (*hetuvidyā*) and ending with medicine (*cikitsāvidyā*) form part of the five sciences (*vidyā*) of the traditional curriculum. Xuanzang mentions that a student began studying these five sciences, along with Buddhist textbooks (*śāstras*), from age seven. With respect to medicine, he says that it embraced exorcising charms, medicine, the use of medicinal stones, needles, and moxa (*mokṣha*) (Beal, 2008; Watters, 2004).



Table 1 List of medicinal plants in the region

Sl. no	Name of the plants	Medicinal properties	Reference in the Pāli texts
1	<i>Achyranthes aspera</i> L.	The plant's historical use in traditional medicine systems for the management of inflammation, wounds, gastrointestinal disorders, respiratory ailments, and pain underscores its cultural significance and therapeutic potential. The pharmacological activities of <i>Achyranthes aspera</i> encompass anti-inflammatory, antioxidant, anti-microbial, analgesic, and immunomodulatory properties, among others (Saurav et al., 2021; Talreja & Tiwari, 2023)	Referred as Moragu. The leaves of this erect grass have soft hair on their underside and the seeds have spikes, so they adhere to animal fur and clothing (Dhammika, 2015)
2	<i>Asparagus racemosus</i> Willd.	The plant has been utilised for therapeutic purposes for millennia, primarily for its recuperative impact on female reproductive organs. Āyurveda describes <i>A. racemosus</i> Willd. as a potent Rasāyāna that slows the ageing process, increases longevity, boosts immunity, and improves mental performance. The roots are used in Āyurveda as a stomachic, aphrodisiac, tonic, and bowel astringent. The roots are used in Unani medicine to cure liver and kidney problems, gleet, and gonorrhoea. This plant's root extract is the principal element in the Āyurvedic formulation 'satavāri mandur', traditionally used to heal gastric ulcers (Sashi et al., 2013)	Sometimes setavāri, uncertain but perhaps asparagus, is mentioned in the Jātaka and Vinaya Pīṭaka. This slender perennial has a woody prickly shoot which can be eaten and a fragrant white flower (Dhammika, 2015)
3	<i>Barleria cristata</i> L.	The ethnomedicinal uses of this plant show the treatment of respiratory diseases like asthma, cough, bronchitis, and tuberculosis. The investigated pharmacological studies reported the presence of anti-inflammatory, anti-bacterial, anti-diabetic, anti-microbial, antioxidant properties, and wound-healing activity (Kumudhaveni et al., 2020)	Referred to as Kuravaka. A small shrub with beautiful, bright rose-coloured flowers (Dhammika, 2015)
4	<i>Barleria prionitis</i> L.	<i>Barleria prionitis</i> L., generally known as Vajradanti is utilized for different illnesses, for example asthma, whooping hack, ailment, fever, heaps, ulcer, wound healing, bleeding diseases, liver diseases, solidness of appendages expanding force, gout, oedema, jungle fever, leukoderma scabies, toothache, joints torment, urinary contamination, jaundice, gastrointestinal clutters, hepatoprotective, snakebites, liver diseases and neuralgia (Shinde et al., 2020)	Referred to as Korandaka. A thorny shrub has yellow flowers and elliptic leaves, each tipped with a spine (Dhammika, 2015)
5	<i>Bauhinia variegata</i> L.	It has phytochemical profiling, anti-microbial, antioxidant, and anticancer activities from the leaf extracts. (Mishra et al., 2013)	Referred to as <i>Kovijāra</i> . The <i>Sūta Nipāta</i> says a monk should give up the marks of a householder, the way the leaves drop off the <i>bauhinia</i> tree. A type of <i>bauhinia</i> called <i>pāricchattaka</i> , meaning literally 'giving broad shade', was believed to grow in the Tāvātimsa heaven, giving great delight to the gods. Flowers from this celestial tree fell from the sky as the Buddha lay dying at Kusinara. The plant is mentioned in <i>Dīghanikāya</i> and <i>Ānguttara Nikāya</i> (Dhammika, 2015)
6	<i>Boswellia serrata</i> Roxb. ex Colebr.	Gum-resin extracts of <i>Boswellia serrata</i> have been traditionally used in folk medicines for centuries to treat various chronic inflammatory diseases (Siddiqui, 2011)	<i>Sallakī</i> . Indian Frankincense (Dhammika, 2015)
7	<i>Brassica rapa</i> L.	Stimulant, diuretic, emetic, rubefacient, counter-irritant. Used externally for bronchitis and rheumatic pains (increases the flow of blood to a specific area). Powdered seeds are used as a tea for colds, influenza, and fever (Khare, 2007)	<i>Siddhatthaka</i> , a white mustard seed, is mentioned in one of the most famous incidents in the Buddha's life related to <i>Kisāgotamī</i> (Dhammika, 2015)



Table 1 (continued)

Sl. no	Name of the plants	Medicinal properties	Reference in the Pāli texts
8	<i>Cardiospermum halicacabum</i> L.	<i>Cardiospermum halicacabum</i> L. is useful as diaphoretic, diuretic, emetic, laxative, refrigerant, stomachic, antibacterial, antioxidant, wound healing, anti-inflammatory, antidiarrheal, antitumor, nervous diseases, itching. Fruits are used for boils, etc. (Dixena & Patel, 2019)	Referred to as <i>Sibala</i> ,
9	<i>Corchorus capsularis</i> L.	The pharmacological studies revealed that the plant possesses cardiac, antioxidant, anti-inflammatory, analgesic, antipyretic, anti-microbial, insecticidal uses (Al-Snafi, 2016; Islam, 2013)	<i>Pothaka</i> - The jute plant grows to a height of about 3 m in the wild or often double that when cultivated. It is most well-known for the strong, shiny fibre produced from it. In Hindi <i>patl</i> is one of several names for the jute plant and the course cloth or canvas made from it (Dhammika, 2015)
10	<i>Dillenia pentagyna</i> Roxb.	Various parts of <i>Dillenia pentagyna</i> Roxb. have been reported to be used by tribals and many folklore communities. The bark of <i>Dillenia pentagyna</i> Roxb. is used for treating diabetes, diarrhoea, cuts, and burns. The Koch Rājbañshī people of western Assam use the seed and the bark of the plant against cancer. The tonic from the bark is considered miraculous for postpartum care. Both leaves and bark are utilized for treating cancer. The paste of the leaf is applied twice a day to cure piles. The ripe fruits are consumed regularly to treat diabetes (Saxena et al., 2022)	Referred to as <i>Āmalaka</i> . Bark: applied to sores and pimples, with the bark of <i>Dillenia pentagyna</i> Roxb. for tubercular fistula; for cholera, dysentery, diarrhoea (Dhammika, 2015)
11	<i>Diospyros montana</i> Roxb.	The plant possesses various pharmacological activities like antiviral, anticancer, antitumor, antimalarial, anthelmintic, prostaglandin synthesis inhibitory, anti-inflammatory, hypolipidemic, and anti-leukemic agents, and several other important medicinal properties (Venugopal & Alagesan, 2022)	Referred to as Timbaru, a small to medium-sized tree with smooth reddish or greenish bark, stout conical thorns, and green or yellow flow-ers. The fruit, which is globose and slightly oblong and with a conical tip, is greenish yellow, gradually turning black (Dhammika, 2015)
12	<i>Garuga pinnata</i> Roxb.	The plant has been used for its anti-inflammatory, antioxidant, anti-cancer, wound healing, antidiabetic activities, and memory boosting qualities (Bhandari et al., 2021)	Kekā, a large tree with smooth, grey flaky bark, yellowish-green globose fruit, and yellow flowers. Juice from the leaves mixed with honey is said to soothe asthma attacks (Dhammika, 2015)
13	<i>Linum usitatissimum</i> L.	Intake of flaxseed in the daily diet may reduce the risk of cardiovascular diseases such as coronary heart disease and stroke. There is also evidence that flax has anticancer effects in breast, prostate, and colon cancers. Flax fibre is used in the textile industry for linen cloth and in the paper industry. The residues remaining after the oil extraction from linseed contain about 35–40% protein and 3–4% oil, a rich source of feed to livestock like cattle and buffalo (Jhala & Hall, 2010)	<i>Khoma</i> , a cloth made from the fibres of the flax plant, also sometimes called linseed. Khoma has been mentioned in the <i>Digha Nikāya</i> and <i>Vinaya Piṭaka</i> . The stems of this annual herb are soaked in water for several weeks and then beaten and scraped to remove the fiber. The seeds also produce a useful oil. The beautiful blue flax flower was called ummāpuppha (Dhammika, 2015)
14	<i>Neolamarckia cadamba</i> (Roxb.) Bosser.	The <i>Cadamba/Kadamba</i> is one of the important medicinal plants belonging to the Rubiaceae family. It is crucially significant as it has the largest number of phytochemicals and secondary metabolites having pharmacological and biological properties (Dwevedi et al., 2015)	Mentioned as <i>Kadamba</i> . The fruit of the tree is extremely sour, round, and covered with a whitish down. The kadamba has nearly disappeared in the wild and is now found mainly in gardens. Wine was flavoured with kadamba flowers (Dhammika, 2015)

Table 1 (continued)

Sl. no	Name of the plants	Medicinal properties	Reference in the Pāli texts
15	<i>Nymphaea nouchali</i> Burm. f.	<i>Nymphaea nouchali</i> Burm. f. (Nymphaeaceae) is an important and well-known medicinal plant, widely used in the Āyurveda and Siddha systems of medicine for the treatment of diabetes, inflammation, liver disorders, urinary disorders, menorrhagia, blemorrhagia, menstruation problems, as an aphrodisiac, and as a bitter tonic. However, considering the magnitude of its traditional uses, the studies conducted are still negligible (Raja, 2010)	<i>Uppala</i> , blue Water Lily, sometimes also referred as <i>indīvara</i> , mentioned in the <i>Jātakas</i> , <i>Vimānavatthu</i> , and <i>Vinayapīṭaka</i> (Dhammika, 2015)
16	<i>Phanera vahlii</i> (Wight & Arn.) Benth.	The herb is extensively used in numerous traditional medical practices, including Āyurveda, Unani, and homeopathy, due to the presence of various important phytoconstituents (Vanampalli et al., 2023)	The Buddha said that passions spread like the <i>mālinā</i> creeper (Dhammika, 2015)
17	<i>Solanum virginianum</i> L.	Pharmacogenetic activities like anti-microbial, anthelmintic, anti-hyperglycemic, hypolipidemic, cardiovascular protective effect, antiulcer, wound healing, and antifertility are validated for this plant (Tekuri et al., 2019)	Known for its use for coughs (Dhammika, 2015)
18	<i>Terminalia elliptica</i> Willd.	The plant bark is astringent and useful in the treatment of ulcers, vāta, fractures, haemorrhages, bronchitis, and diarrhoea. The plant has not been investigated for its anti-inflammatory and antiarthritic activity (Reddy et al., 2019)	Referred to as <i>Asana</i> . A very common large tree with its bark cracked into oblong segments and with elliptic or sometimes oblong leaves (Dhammika, 2015)
19	<i>Vitex negundo</i> L.	The plant is known to possess anticancer, antimicrobial, antifungal, anti-inflammatory, anti-hyperpigmentation, hepatoprotective, antihistaminic, analgesic, and related activities. Scientifically explored exhaustive reports of the plant, their medicinal properties, and active chemical constituents have a role in the management of various human ailments (Panda et al., 2014; Venkateswarlu, 2012)	Referred to as <i>Niggundi</i> . A large shrub with a distinct smell, leaves covered with fine hair, and white or sometimes lavender flowers (Dhammika, 2015)
20	<i>Ziziphus oenopolia</i> (L.) Mill.	The plant produces cyclopeptide alkaloids known as ziziphines and has major biomedical applications. In India, the roots are used in Ayurvedic medicine. The plant is known for the ulcer, stomach ache, obesity, asthma, and it has an astringent, digestive, antiseptic, hepatoprotective, wound healing, and diuretic property (Nahrin et al., 2022; Shukla et al., 2016)	<i>Takkola</i> . A sweet substance made from this thorny evergreen shrub that climbs up against other trees and produces a small black edible berry (Dhammika, 2015)



5 Concepts of *Bhaiṣajyarājan* and *Bhaiṣajyaguru* as healers

During the latter half of the seventh century CE, the other Chinese pilgrim, I-Ching (Yijing) visited many monasteries in India, particularly Nalanda, on which he left a detailed account. However, the accounts vary from Xuanzang because I-Ching's records mostly focus on correcting the Vinaya rules' misinterpretations and refuting the erroneous opinions held by the schools of the *Vinayadhārās* then existing in China. He therefore dwells chiefly on the monastic life and discipline of his time, but mingled with important information regarding the regular lives of the monks within the monasteries. Good health and wellbeing were extremely essential as part of the monastic life. I-Ching dedicated three chapters on the discussions of the body, food, medicines, and monastic wellbeing. He emphasized that illness is caused by much eating or labour. He refers to cholera morbus, which was a tough disease to handle, particularly for the poor people who could not afford the pills (Takakusu, 1998).

The idea of wellbeing and healing being central to the Buddhist order could be practiced and propagated with the availability of natural resources that made living rather sustainable for the larger society. Hence, the places for meditation and monastic establishments were wisely chosen. Nalanda Mahāvihāra remains one of the finest examples in this regard. The ideas and concept of a healing and compassionate Buddha (medicine Buddha) emerged and eventually gained prominence with the growth of Mahāyāna Buddhism. Eric Frauwallner (cited in Zysk, 1991) studied the *skandhakas* of the extant *Vinayas* and drew our attention to the chapter on the medicines, *Bheṣajjakhandaka* (Pāli), which is the oldest and most original section of the *Vinayas* with the earliest forms of Buddhist monastic medicines (Zysk, 1991). Along with this, the Sanskrit composition of the *sūtra Saddharmapūṇḍarikā* enumerates the concept of the universal healer as *Bhaiṣajyarājan*, the royal physician, who was also referred to as *Bhaiṣajyaguru* (Zysk, 1991). The perception of the Buddha in the form of a healer aided in the unification of the body and the mind through the acknowledgement of the healing Bōdhisattva. It was believed that in reciting the names or pronouncing the Dharaṇīs, the followers would be blessed with good health and a virtuous life. Eventually, the image of the healer Bōdhisattva got absorbed in the Mahāyāna practices of East Asia. According to Zysk, the healing Buddha in the form of *Bhaiṣajyaguru*, seemingly linked to the worship of *Bhaiṣajyarājan*, developed as a cultic worship in central Asia and Kashmir around third century CE, which spread to China around fourth century CE (Zysk, 1991). This belief gradually assimilated itself within the fold of Mahāyāna works of East Asia and had an entire sutra named *Bhaiṣajyagurusutra* devoted to his worship (Divino,

2023). Divino emphasizes tracing the originality of the Buddhist medical system without the part that was shared from the *Aṣṭāṅgahrdayasaṃhitā*. He draws our attention to the first medical treatise named *Bheṣajjamañjuṣā*, written in the Pāli language. Though it is a very late work, probably produced in the thirteenth century in Ceylon by a Theravada monk named Pañcaparivenādhīpati who wrote during the rule of Parākkamabāhu II, it is still the first systematization of medical art within the Buddhist context (Divino, 2023). The treatise has numerous affinities with other medical treatises such as the *Aṣṭāṅgahrdayasaṃhitā*, with which it shares about one-third of its contents. What is significantly pointed out by Divino is perhaps *Pañcaparivenādhīpati* had extensive knowledge of the Pāli canon and thus sought to align his medical system with the most authoritative one testified in the episodes of the Buddha's life (Divino, 2023). The observations of interest here is how the concept of the healing Buddha as *Bhaiṣajyarājan* and *Bhaiṣajyaguru* were incorporated for preaching the healing role of the Buddha, the medicine Buddha, and further propagated through texts and practices to be absorbed in Mahāyāna Buddhism in the south and Southeast Asia.

Buddhism's focus on healing and healthcare initiated the monasteries' medicinal doctrines and wellness programme. The monks took charge of treating the fellow monks and the laity and reaching out to the larger society through the practice of serving and nurturing the local communities through medical and spiritual guidance. Therefore, monasteries gradually expanded their networks by providing spiritual motivation, guidance, ordination, and health care facilities for the general people in the hinterland of the monastic establishments. People joined the Saṅgha specifically to be treated by Jīvaka, which perhaps created a disorder resulting in the prohibition of the ordination of the sick. Jīvaka was the chief surgeon residing in Rājagṛha during the time of the Buddha and has been extensively mentioned in the Pāli, Sanskrit, Tibetan, and Chinese sources (Schopen, 2017). While the Asokan edicts do refer to the medical care facilities for the travellers, excavations at the archaeological site of Kumrahar, identified as the Mauryan capital, have strengthened our assumption of the hospital and care centres (Singh, 2024). The sealings and the building complex unearthed during the excavations at Kumrahar, justify the Buddhist association and affirm the dates of the structural complex to be around 300–400 CE² (Singh, 2024). The inscription on the sealing reads the lines—*śrī ārogyavihāre bhikshusaṅghasya*. The inscribed lines of the fragmentary potsherds also identify the complex at Kumrahar as *ārogyavihāra* and refer to (*dha*) *nvanterah*. Other than the Kumrahar complex, a part of the structural complex identified as Jīvaka Āmravana, in

² Indian Archaeology-A Review Report, IAR 1953–54: 10.



the old city of Rājagṛha has been identified by the excavators as constituting the first hospital complex of the region.³ Zysk calls for our attention towards the Pāli canon, indicating a ‘hall of the sick’ (*gilānasālā*), located at the hall of the peaked gable in the great forest near Veśālī with a part of the monastic structure dedicated to the treatment of the sick brethren. Similar inscription from the site of Nagarjunakonda of third century CE bespeaks the importance of well-being, where a health house for the sick and those recovering from fever was included within the premises of the Buddhist monastery (Zysk, 1991).

The health care units that were added to the Buddhist monasteries not only served the monks but also the immediate hinterland. In this connection, Furuī calls for our attention because he emphasises how proactively these monastic establishments were built and how these complexes catered to society’s political, social, and economic needs. The Guṇaighar copper-plate inscription of Vainyagupta, dated to 507 CE, records the donation of land in five plots by a copper plate grant (*tāmrapaṭṭena*). The inscription mentions the practical purposes of donation, in which we find the mention of *glānapratyayabhaisajya*, interpreted as medicines for the sick. Another interesting fact noted in the inscription is the nature of the land donations to the religious institutions; further the absence of any reference of Vainyagupta, the donor, or Rudradatta, the petitioner, to have made relevant arrangements indicates the role played by the Buddhist *vihāra* around this time (Furuī, 2023). The other grant, the Jayarampur plate of the time of Gopachandra, pertains to the area of Rāḍha bordering parts of Bengal and Odisha. Gopachandra, who was among the rulers who gained sovereignty in the second half of the sixth century, following the collapse of the Gupta rule, in the sub-regions of Vaṅga (center-south), Rāḍha (west), and Puṇḍravardhana. The inscription mentions the *mahāsāmanta mahārājā* Acyutā, a subordinate ruler, who asked the Adhikaraṇa and associated people to sell him the village Śvetavālikāgrāma to donate it for the construction of a *vihāra*, with the usual practice of the rituals of offerings, which enlists the regular items along with *glānapratyayabhaisajyapariṣkāra*, a preparation or an equipment for medicine as a requirement for the sick. Furuī, while elaborating on the meaning of *glānapratyaya bhaisajyapariṣkāra*, gives us two interpretations; he states that while *glānapratyayabhaisajya* is interpreted as ‘medicine to cure the sick’, which is one of the four *pariṣkāra*, *glānapratyayabhaisajyapariṣkāra* could rather denote cloth kept as a fund for purchasing medicines, a requisite for the sick. In the Mūlasarvāstivāda Vinaya texts also translated by I-Ching, the Buddha is said to have ordered that *bhikṣus*

keep *yāozhīyī*, listed as the last of the thirteen kinds of cloth, to sell for supplying medicine when they encounter disease (Furuī, 2023). Medicines and the proper usage and storage of medicines were no doubt important for the Buddhist monasteries and how these were used for the treatments and applications must have been a specialised task for the monks living in the monasteries. Since the inception of the saṅgha, the Buddha emphasized the four necessary requisites: i.e. food, robe, shelter, and medicine. Medicine as a necessary requirement led to the development of medical arrangements exclusive to the Saṅgha (Horner, 1952).

6 Conclusion

The initiatives in Buddhist practices for holistic healing of all sentient beings and preservation of the universe’s natural order have been significantly evident throughout the passage of time. In what ways were the ideologies and practices of good health and morality held upright and sustained? This is systematically preserved in the texts and is well corroborated by the material vestiges of the past. From the onset of the Buddhist faith and order, nurturing the earth (*bhūmi*) and being connected to the *bhūmi* has been fundamental. The earth or the *bhūmi* remains witness to the illustrious moment of enlightenment of the Buddha, with the shelter being provided by the sacred *Bodhi* tree (*Ficus religiosa* L.) that continues to be the focal point of worship. The importance of the animal world is equally evident in the scriptures, the events of the master’s life, and the artistic expressions on the Buddhist sculptures. *Stūpa*, which is fundamental to the Buddhist practice and ritual, is the earthen mound consecrating the sacred remains of the Buddha. *Stūpa*, as argued by Fogelin, represents a form of emotional immediacy because of its direct association with the land (*bhūmi*) as well as the relics of the Buddha. With the omission of the relics and reduction of this emotional connection in the later stupas, the focus had to shift to the creation of the Buddha images (Fogelin, 2014). However, in the sculptural depictions of the Buddha, the constant presence of nature and the constituent beings remains evident along with the subtle expressions and semiotic significance of everyday lives.

The Buddhist emphasis on environmental and ecological harmony is well reflected and preserved in the natural surroundings of the Mahāvihāra complex at Nalanda. The hinterland sites supporting the monastic complex were largely agricultural settlements with sufficient reserves of food crops, minerals, and other necessary resources. Two key insights emerge from the discussions. The Nalanda monastic complex and the Rājagṛha capital site were not isolated; they had connections with the ancient cities, markets, and villages of the immediate and extended hinterland. The convergence of trade routes in these

³ Indian Archaeology-A Review Report, IAR 1958–59.



areas is well-documented. Initially, sites like Rājagrha may have been chosen for their strategic location where structural establishments could be raised with chosen donations from individuals and merchant guilds. The convergence of trade routes around these areas is well cited and documented.

Initially, Nalanda might have served as a *bāhirikā* for Rājagrha, providing a tranquil retreat for the monks and scholars. However, the dynamics reversed over time, and Nalanda emerged as the hub of higher learning and meditation. Yet, Rājagrha's importance never eclipsed; it continued as a major support system to the monastery. Hence both sites are seen in conjunction along with the small-scale archaeological sites of the vicinity. Fogelin (2014) emphasizes how the initial secluded retreats expanded over time and developed into centres of networking, communication, and exchange. These exchange networks were not only meant for the daily essentials but for the propagation and circulation of ideas, beliefs, and knowledge systems. Over time, from ancient to medieval periods, the significance of Nalanda's topography and natural surroundings remained unwavering, consistently influencing the region's cultural, spiritual, and intellectual landscape. Secondly, the availability of the healthcare facilities within the monastery, along with flourishing academic and cultural pursuits, demonstrates the strength and effectiveness of the monastic order. These aspects need more dedicated research with introspection on the available healthcare facilities, including hospitals and care units associated with the Buddhist establishments. The importance of medicine, as enumerated in the Buddhist texts, demands a cautious approach to understand how these amenities were incorporated within the fold of Buddhism and how these practices served the monasteries and the larger society. The majestic monastic complex at Nalanda poses an intriguing paradox, however- how did its construction, reliant on vast quantities of baked bricks, align with the site's emphasis on environmental stewardship? The grand structure's sheer scale reveals the immense resources needed to build it, highlighting significant consumption of energy (fuel), water, and natural resources (clay, sand, earth). To resolve this ecological mystery, we may investigate the historical environmental records of the region and explore the traditional Indian architectural practices prioritizing environmental harmony and holistic wellbeing for all.

Acknowledgements We remain indebted to the Indian National Science Academy for funding the Project (No. HS/RC, June 13, 2022). We are also thankful to the Bihar Heritage Development Society for the help and support. The first author is grateful to the Royal Asiatic Society of Great Britain and Ireland, London, for the permission to study the reports of Francis Buchanan (1814).

Funding Indian National Science Academy, HS/RC dated 30.06.2022, Sharmistha Chatterjee

Data availability The data that supports the findings of this study are available within the article and in the references mentioned. Any further information is available from the corresponding author upon reasonable request.

Declaration

Conflict of interest The authors have no conflicts of interest to disclose.

Competing interests The authors have no competing interests to declare.

References

- Al-Snafi, A. E. (2016). The contents and pharmacological importance of *Corchorus capsularis*—A review. *IOSR Journal of Pharmacy*, 6(6), 58–63.
- Beal, S. (2008). *The life of Hiuen-Tsiang by the Shaman Hwui Li*. Low Price Publication.
- Bhandari, R., Gyawali, S., Aryal, N., et al. (2021). Evaluation of phytochemical, antioxidant, and memory-enhancing activity of *Garugapinnata* Roxb. bark and *Bryophyllum pinnatum* (Lam) Oken leaves. *The Scientific World Journal*, 1, 1–7. <https://doi.org/10.1155/2021/6649574>
- Buchanan, F. (1814). *Statistical survey of the districts of Behar and the city of Patna by Francis Hamilton (Vol I & II)*. Superintendent. Government Printing Press.
- Dhammika, S. (2015). *Nature and the environment in early Buddhism*. Buddha Dhamma Mandala Society.
- Divino, F. (2023). Elements of Buddhist medical system. *History of Science in South Asia*, 11, 22–62.
- Dixena, D., & Patel, D. K. (2019). Morphology and medicinal values of *Cardiospermum halicacabum*. *Flora and Fauna*, 25(2), 167–176.
- Dorzhighushaeva, O. V., & Kiplyuks, A. V. (2020). Environmental ethics of Buddhism. *International Journal of Environmental Science and Development*, 11(3), 154–158.
- Dwevedi, A., Sharma, K., & Sharma, Y. K. (2015). Cadamba: A miraculous tree having enormous pharmacological implications. *Pharmacognosy Reviews*, 9(18), 107–113. <https://doi.org/10.4103/0973-7847.162110>
- Edney, M. H. (1997). *Mapping an Empire: The geographical construction of British India, 1765–1843*. University of Chicago Press.
- Fogelin, L. (2014). Material practice and the metamorphosis of a sign: Early Buddhist stupas and the origin of Mahayana Buddhism. *Asian Perspectives*, 51(2), 278–310.
- Furui, R. (2023). Buddhist vihāras in early medieval Bengal: Organizational development and historical context. *Buddhism. Law and Society*, 2022, 99–142.
- Horner, I. B. (1952). *The book of the disciple: Vinaya-Pitaka (Vol. V)* (Vol. V). Luzac and Company Ltd.
- Islam, MMd. (2013). Biochemistry, medicinal and food values of Jute (*Corchorus capsularis* L. and *C. olitorius* L.) leaf: A review. *International Journal of Enhanced Research in Science Technology & Engineering*, 2(11), 35–44.
- Jackson, V. H. (Ed.). (1925). *Journal of Francis Buchanan (afterwards Hamilton). Kept during the survey of the districts, of Patna and Gaya in 1811–1812*. Superintendent, Govt. Printing.



- Jha, Satyendra Kumar. (2011). *Rājagṛha: The city of eminence*. Bihar Heritage Series 1: K.P. Jayaswal Research Institute.
- Jhala, A. J., & Hall, L. M. (2010). Flax (*Linum usitatissimum* L.): Current uses and future applications. *Australian Journal of Basic and Applied Sciences*, 4(9), 4304–4312.
- Khare, C. (2007). *Brassica campestris* Linn var. *rapa* (L.) Hartm. In C. Khare (Ed.), *Indian medicinal plants*. Springer.
- Kumudhaveni, B., Radha, R., Jiyavutheen, M., Kavithasai, M., & Kowsalya, J. (2020). A review on phytochemical and pharmacological activity of medicinal plant *Barleria cristata*. *Research Journal of Pharmacy and Technology*, 13(2), 999–1003. <https://doi.org/10.5958/0974-360X.2020.00185.7>
- Mishra, A., Sharma, A. K., Kumar, S., Ajit, K., & Pandey, A. K. (2013). *Bauhinia variegata* leaf extracts exhibit considerable antibacterial, antioxidant, and anticancer activities. *BioMed Research International*. <https://doi.org/10.1155/2013/915436>
- Nahrin, A., Junaid, M., Afrose, S. S., et al. (2022). *Ziziphus oenoplia* Mill: A systematic review on ethnopharmacology, phytochemistry and pharmacology of an important traditional medicinal plant. *Mini Review in Medicinal Chemistry*, 22(4), 640–660. <https://doi.org/10.2174/1389557521666210810153311>
- Panda, P., Das, B., Sahu, D. S., et al. (2014). Uses of *Vitex negundo* Linn (Nirgundi) in Ayurveda and its pharmacological evidences. *Research Journal of Pharmacology and Pharmacodynamics*, 6(3), 162–165.
- Paul, S. R. (1981). Flora of Rajgir, Bihar. *The Journal of the Bombay Natural History Society*, 78, 16–37.
- Raja, M. K., Sethiya, N. K., & Mishra, S. H. (2010). A comprehensive review on *Nymphaea stellata*: A traditionally used bitter. *Journal of Advanced Pharmaceutical Technology & Research*, 1(3), 311–319. <https://doi.org/10.4103/0110-5558.72424>
- Reddy, J., Srinivasa, D. P., Gourishetti, K., et al. (2019). *Terminalia tomentosa* bark ameliorates inflammation and arthritis in carrageenan induced inflammatory model and Freund's adjuvant-induced arthritis model in rats. *Journal of Toxicology*. <https://doi.org/10.1155/2019/7898914>
- Sashi, A., Jain, S. K., Verma, A. K., Mayank, M. A., & Sabharwal, M. (2013). Plant profile, phytochemistry and pharmacology of *Asparagus racemosus* (Shatavari): A review. *Asian Pacific Journal of Tropical Disease*, 3, 242–251. [https://doi.org/10.1016/S2222-1808\(13\)60049-3](https://doi.org/10.1016/S2222-1808(13)60049-3)
- Saurav, Y., Mishra, A. P., Kumar, S., Negi, A., & Maurya, V. K. (2021). Herbal wound healing agents. In C. Egbuna, A. P. Mishra, & M. R. Goyal (Eds.), *Preparation of phytopharmaceuticals for the management of disorders*. Academic Press.
- Saxena, H. O., Samiksha, P., & Das, A. (2022). *Dillenia pentagyna* Roxb.: A review on phytochemistry and pharmacology. *The Journal of Phytopharmacology*, 11(4), 295–299. <https://doi.org/10.31254/phyto.2022.11413>
- Schopen, G. (2017). The training and treatments of an Indian doctor in a Buddhist text: A sanskrit Biography of Jivaka. In C. Pierce Salguero (Ed.), *Buddhism and medicine—An anthology of premodern sources*. Columbia University Press.
- Shinde, S. S., Tare, H. L., Deshmukh, N. S., Chaudhari, S. R., Ghangale, G. D., & Udugade, B. V. (2020). Pharmacognosy, phytochemistry and traditional uses: *Barleria prionitis*. *Bulletin of Environment, Pharmacology and Life Sciences*, 9(4), 150–158.
- Shukla, A., Garg, A., Mourya, P., & Jain, C. P. (2016). *Ziziphus oenoplia* Mill: A review on pharmacological aspects. *Advance Pharmaceutical Journal*, 1(1), 8–12.
- Siddiqui, M. Z. (2011). A potential anti-inflammatory agent: An overview. *Indian Journal of Pharmaceutical Sciences*, 73(3), 255–261. <https://doi.org/10.4103/0250-474X.93507>
- Singh, A. (2010). Ecological consciousness in Buddhist theism: Anthropocentric Teleological Issues. In: *Proceedings of the Indian History Congress*, 70: 92–100. www.jstor.org/stable/44147659. Accessed 8 Feb 2024.
- Singh, A. (2024). *Nalanda—A glorious past*. Primus Books.
- Takakusu, J. (1998). *A record of the Buddhist religion as practiced in India and the Malay archipelago (AD 671–695) by I-Tsing*. Munshiram Manoharlal Publishers.
- Talreja, S., & Tiwari, S. (2023). A comprehensive review of *Achyranthes aspera*: Ethnopharmacology, phytochemistry, and therapeutic potential. *Ayushdhara*, 10(5), 270–278.
- Tekuri, S. K., Pasupuleti, S. K., Konidala, K. K., et al. (2019). Phytochemical and pharmacological activities of *Solanum surattense* Burm. f.—A review. *Journal of Applied Pharmaceutical Science*, 9(3), 126–136.
- Vanampalli, S., Srivani, A., Mohan, K. G., & Suneesha, D. (2023). A review on *Bauhinia vahili* wright & Arn. *International Journal of Herbal Medicine*, 11(1), 30–39.
- Venkateswarlu, K. (2012). *Vitex negundo*: Medicinal values, biological activities, toxicity studies and phytopharmacological actions. *International Journal of Pharmaceutical and Phytopharmacological Research*, 2(2), 126–133.
- Venugopal, S., & Alagesan, V. (2022). Brief review of the genus *Diospyros montana* phytopharmacological properties. *Extensive Reviews*, 2(1), 11–19. <https://doi.org/10.21467/exr.2.1.4572>
- Watson, M. F., & Noltie, H. (2016). Career, collections, reports and publications of Dr Francis Buchanan (later Hamilton), 1762–1869: Natural history studies in Nepal, Burma (Myanmar), Bangladesh and India (part 1). *Annals of Science*. <https://doi.org/10.1080/00033790.2016.1195446>
- Watters, T. (2004). *On Yuan Chwan's travels in India (AD 629–645)*. Royal Asiatic Society.
- Zysk, K. G. (1991). *Asceticism and healing in ancient India: Medicine in the Buddhist monastery*. Oxford University Press.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.

