

Bhimal (*Grewia optiva*):

A miracle tree with the potential to improve livelihood security of himalayan farming communities

Tilak Mondal, Namrata Laskar, Nilimesh Mridha, Atul Singha, Avijit Das* and D. B. Shakyawar

ICAR-National Institute of Natural Fibre Engineering and Technology, Regent Park, Kolkata 700 040

Bhimal is widely distributed in the sub-Himalayan region, especially Uttarakhand. It is known for its versatile use, such as durable fibre, nutritious fodder, fuelwood, and medicinal products. It also holds cultural and religious importance and is significant in local rituals and traditions. Bhimal serves as a vital component in rural livelihood of Himalayan farming communities. It can grow in challenging Himalayan terrains and can prevent soil erosion and improve soil fertility. With its adaptability to challenging conditions and its wide range of uses, bhimal can enhance both economic and environmental outcomes, ensuring a more resilient and prosperous future for the Himalayan farmers.

Keywords: Bhimal, Fibre, Fodder, Himalayan farming

BHIMAL (*Grewia optiva*), native to the sub-Himalayan region, especially Uttarakhand, is a vital component of the agroecological system and rural livelihoods in the Himalayas. Bhimal is known for its versatility, providing essential resources such as durable fibre, nutritious fodder, fuelwood, and medicinal products, making it invaluable for smallholder farmers. It also holds cultural and religious importance and is significant in local rituals and traditions. In the challenging Himalayan terrain, characterized by erratic weather and limited agricultural resources, bhimal stands out for its adaptability and year-round utility. Its nutrient-dense leaves serve as a critical livestock fodder source during lean periods, while its bark yields strong fibre traditionally used for crafting ropes and other household items. The tree's drought tolerance and ability to thrive in poor soils make it a sustainable and resilient resource for rural households.

Ecologically, bhimal contributes significantly to soil conservation and biodiversity. Its deep root system mitigates soil erosion, a prevalent issue in hilly areas, while its ability to recycle nutrients and add organic matter enhances soil fertility. It also plays an integral role in agroforestry, improving crop yields by offering shade, protecting crops from wind, and retaining soil moisture. Beyond its ecological and agricultural benefits, bhimal presents opportunities for income generation through the sale of fodder, fibre, and medicinal products. This enhances rural income and bolsters economic resilience. Bhimal has the potential to tackle key issues like food insecurity, environmental degradation, and rural poverty, making it a viable solution for improving livelihoods.

Phenology of bhimal

Bhimal is a remarkable tree species well-adapted to the unique climatic and environmental conditions of the sub-Himalayan region. Its phenological traits

highlight its resilience and importance within the local ecosystem and farming practices. As a deciduous tree, bhimal sheds its leaves from December to February, with new leaves emerging in March and April, preparing it for the growing season. The flowering period occurs between April and June, during which small yellowish flowers bloom in clusters, attracting pollinators essential for fruit development. Fruits mature from July to September, providing food for birds and wildlife.

Bhimal as a source of high-quality fibre

Bhimal is recognized for its high-quality fibre, making it a valuable resource for various applications in textiles, handicrafts, and other industries. Its fibre is biodegradable and shows insect repellent, anti-microbial properties. Bhimal fibre is very long and fine, and have great tensile strength, which makes it durable and suitable for various applications. Longer fibres are often preferred in textile production as

they can be spun into yarns more efficiently and lead to smoother finished products. Further, bhimal fibre typically has a natural brownish hue, which can add aesthetic value to textiles and crafts.

- **Extraction process:** The traditional method of bhimal fibre extraction involves a process known as retting, where the plant materials are dipped in water bodies and then beating it to extract fibres from the woody stems. This method is eco-friendly and aligns with sustainable agricultural practices. After retting, the fibres are washed, dried, and combed to remove impurities, resulting in clean, high-quality fibres ready for use in various applications. Different chemical treatments are also available to extract bhimal fibres, such as urea retting which doesn't pollute water bodies as in case of traditional retting method.
- **Modification of extracted fibres:** The chemical constituents of bhimal fibres depends upon retting procedures and extraction techniques. The lignin content of bhimal fibres ranges in between 14–16%. Lignin is stiff and hydrophobic in nature, which makes the bhimal fibres rigid and less flexible. Hence, removal of lignin is necessary to increase flexibility of the extracted fibres, making the fibres more appropriate for textiles and composite preparation. Delignification of bhimal fibres can be done by chemical treatments, viz. sodium hydroxide, acetic acid and sodium chlorite, to make the fibres more appropriate for textiles and composite preparation. Bleaching with hydrogen peroxide, is practiced enhancing the whiteness of extracted fibres, which is followed by treatment with softener like amino modified poly siloxane to add lustre and smoothness to fibres. Then the fibres are combed and subjected to yarn preparation.
- **Applications of bhimal fibre:** Bhimal fibre can be woven into

fabrics and used to make cloth, bags, and other textile products. Its strength and durability make it suitable for heavy-duty applications such as sacks and tarpaulins. Local artisans utilize bhimal fibre to create a variety of handicrafts, including baskets, mats, and decorative items. The fibre's natural appearance and workability allow for creative expression while supporting local economies. Bhimal fibre is also used in making biodegradable products, contributing to sustainable practices. As an alternative to synthetic fibres, it can help to reduce plastic waste in the environment. In addition, the fibre blends well with other fibres (cotton, viscose, etc.) in different ratios and can be used in preparation of gauze and bandages, masks, clothing for the medical industry.

By providing a source of income through fibre production, bhimal supports local economies and encourages sustainable farming practices. As demand for natural and eco-friendly products increases globally, bhimal fibre has the potential to gain greater market recognition, further enhancing its economic significance for farmers and artisans.

Fodder source

Bhimal is highly regarded for its superior fodder quality, especially during the lean periods when other resources are scarce. The leaves of Bhimal are rich in nutrients, making them an excellent food source for livestock such as cows, buffaloes, goats, and sheep. Bhimal leaves are a significant source of nutrition for livestock, providing a balanced composition of proteins, vitamins, and essential minerals. Their nutritional value contributes to the health and productivity of animals, particularly in regions where conventional fodder may be scarce.

Bhimal leaves contain approximately 10–12% protein, which is crucial for growth, maintenance, and overall health in livestock. Protein plays a vital role in muscle development, tissue repair, and

immune function, making bhimal leaves an excellent supplementary feed source for animals, particularly during lean periods when other fodder is limited. The leaves are rich in essential minerals, notably calcium and phosphorus, which are vital for various physiological functions in animals. Calcium is essential for strong bones and teeth, blood clotting, and muscle function. It plays a significant role in lactation and overall metabolic processes, contributing to the well-being of dairy animals. Phosphorus is critical for energy metabolism, supports reproductive health, and is involved in the formation of bones and teeth. It also aids in the absorption of calcium, promoting optimal bone health and development. In addition to protein and minerals, bhimal leaves provide other important nutrients such as vitamins (A, B and C), fibre and antioxidants.

Overall, the nutritional composition of bhimal leaves makes them a valuable fodder resource, enhancing livestock health and productivity. Their balanced protein, mineral content, vitamins, and fibre contribute to improved growth rates, milk production, and reproductive performance, making them an essential part of the diet for animals in Himalayan farming communities.

Table 1. Nutritional composition of bhimal leaves

Sl. No.	Nutritional component	Nutrient content (Per 100 g)
1	Protein	20–25 %
2	Fat	12–17 %
3	Ash	1.5–1.8 %
4	Fibre	20–23 %
5	N	3.2–3.6 %
6	P	1.2–1.25 %
7	K	1.6–2.0 %
8	Ca	5.5–6.0 %
9	Fe	275–300 ppm
10	Mn	75–80 ppm
11	Zn	35–40 ppm
12	Cu	4.1–4.5 ppm
13	Vitamin-A	300–500 IU
14	Vitamin-C	20–30 mg
15	Energy Content	50–70 kcal

(Source: Mondal et al. 2016)

Impact on livestock farming:

Bhimal leaves are notably versatile, making them an essential resource for livestock feed, especially in regions where green fodder is scarce. This is particularly advantageous during the dry winter months when many traditional fodder sources are limited. Farmers often harvest bhimal leaves during the growing season and dry them for storage. Dried leaves retain their nutritional value and can be used as a supplementary feed during periods of scarcity. The nutritional quality of bhimal leaves has a significant positive impact on livestock health and productivity.

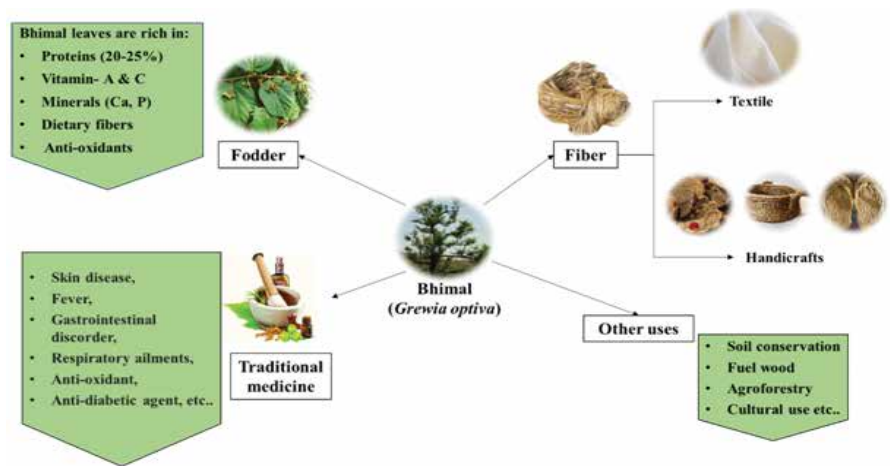
By incorporating bhimal leaves into their livestock feeding practices, farmers can reduce dependence on costly commercial feed and improve the nutritional quality of their livestock's diet. This leads to better economic outcomes, as healthier and more productive animals contribute to increased farm profitability.

Medicinal use

Bhimal has a rich history of use in traditional medicine among the Himalayan farming communities. Various parts of the tree are utilized to treat a wide range of ailments. Bhimal leaves, and bark are used to treat skin conditions, gastrointestinal issues, and respiratory ailments. The leaves are known to have anti-inflammatory and antimicrobial properties. Subsequently, decoctions made from bhimal bark are often used to relieve joint pain and to treat wounds and cuts due to their healing properties. Recent studies have indicated the potential of bhimal in pharmaceutical applications, particularly for its anti-diabetic and antioxidant properties. Further exploration of its medicinal value could lead to new healthcare solutions derived from this native plant.

Religious and cultural significance

Bhimal holds significant religious and cultural importance in the Himalayan region. Farmers in Uttarakhand and neighbouring areas use bhimal during various rituals and religious ceremonies. The leaves and branches of bhimal are



Graphical abstract

often used in local religious festivals and ceremonies, such as weddings and harvest festivals. In some communities, the tree is considered sacred and is protected as a symbol of prosperity. Bhimal is deeply intertwined with the traditional farming lifestyle, representing resilience and abundance. Its integration into religious and cultural practices further enhances its importance within the local farming communities.

Future potential for improving livelihood security

Bhimal's versatility and resilience make it a key component in strategies aimed at improving livelihood security in the Himalayas. As climate change and resource scarcity increasingly challenge rural communities, bhimal's role is likely to grow in importance.

- **Climate resilience:** Bhimal is well adapted to the harsh climatic conditions of the Himalayas, making it a reliable source of fodder, fibre, and other resources, even in times of environmental stress. Its drought tolerance further strengthens its role in sustainable farming systems.
- **Economic benefits:** Promoting bhimal cultivation and utilization can generate additional income streams for farming communities. Its applications in fodder production, fibre industries, and medicinal products can contribute to rural development and poverty alleviation.
- **Sustainable development:**

Bhimal aligns with the goals of sustainable agriculture by enhancing soil fertility, reducing the need for chemical inputs, and promoting biodiversity. Its potential for carbon sequestration also supports environmental conservation efforts in the region.

- **Research and development:** Future research could focus on optimizing bhimal's productivity and exploring its commercial potential in sectors such as eco-friendly textiles, pharmaceuticals, and bioenergy. This would further enhance its role in improving the livelihood security of farming communities in Uttarakhand and other Himalayan regions.

SUMMARY

Bhimal stands out as a "miracle tree" with immense potential to improve the livelihood security of Himalayan farming communities. Its fodder, fibre, medicinal and cultural value make a critical resource for the region's rural population. By promoting the sustainable use and development of bhimal, it is possible to enhance both economic and environmental outcomes, ensuring a more resilient and prosperous future for the Himalayan farmers. With its adaptability to challenging conditions and its wide range of uses, bhimal is poised to become a cornerstone of sustainable rural development in Uttarakhand and beyond.

*Corresponding author email: avjiticrri@gmail.com