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Review Article

***Pyracantha Crenulata*: A Review of Its Botanical Features, Ecological Significance, And Horticultural Potential**

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ABSTRACT

Pyracantha crenulata, commonly known as Nepalese firethorn or Himalayan firethorn, is a species of flowering plant that has garnered attention for its aesthetic appeal, ecological significance, and potential in horticulture. This review article provides a comprehensive examination of *Pyracantha crenulata*, focusing on its botanical features, ecological roles, and horticultural applications. Through a thorough analysis of existing literature, this review aims to elucidate the key characteristics and attributes of *Pyracantha crenulata*, shedding light on its importance in both natural ecosystems and cultivated settings. The introduction section provides background information on *Pyracantha crenulata*, outlining its taxonomic classification and geographical distribution. It also introduces the significance of studying this species in terms of its ecological functions and horticultural value [2]. The botanical features of *Pyracantha crenulata* are thoroughly examined, encompassing aspects such as morphology, leaf characteristics, flowering patterns, and fruit development. The ecological significance of *Pyracantha crenulata* is also explored, highlighting its role in supporting biodiversity, providing habitat and food for wildlife, and contributing to ecosystem services such as pollination and soil stabilization. Furthermore, the horticultural potential of *Pyracantha crenulata* is discussed, including its suitability for landscaping, its adaptability to various growing conditions, and its maintenance requirements [17]. The conclusion section summarizes the key findings of the review, emphasizing the importance of *Pyracantha crenulata* in both natural and cultivated environments. It underscores the need for further research and conservation efforts to safeguard this species and maximize its ecological and horticultural benefits. Finally, the future prospective section outlines potential avenues for future research and development concerning *Pyracantha crenulata*. Overall, this review provides valuable insights into *Pyracantha crenulata*, highlighting its multifaceted significance and its potential contributions to biodiversity conservation and sustainable horticulture [16].

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INTRODUCTION

Pyracantha crenulata, commonly known as Nepalese firethorn or Himalayan firethorn, is a species of flowering plant that holds significance both in natural ecosystems and cultivated landscapes. Belonging to the Rosaceae family, *Pyracantha crenulata* is native to the Himalayan region, with its distribution spanning Nepal, Bhutan, and parts of India. This species has attracted considerable attention from botanists, ecologists, and horticulturists due to its distinctive botanical features, ecological roles, and horticultural potential. Understanding *Pyracantha crenulata* is essential for appreciating its contributions to biodiversity conservation and its value in ornamental horticulture. Taxonomically, *Pyracantha crenulata* is classified within the genus *Pyracantha*, which comprises several species commonly referred to as firethorns. These plants are renowned for their dense foliage, showy flowers, and colourful berries, which make them popular choices for gardens, parks, and urban landscapes [8]. The geographical distribution of *Pyracantha crenulata* encompasses a range of habitats, from montane forests to scrublands and disturbed areas. This adaptability underscores its ecological resilience and its ability to thrive in diverse environmental conditions. Moreover, *Pyracantha crenulata* plays essential ecological roles in its native habitats, providing habitat and food for wildlife, supporting pollinator populations, and contributing to ecosystem stability. In addition to its ecological significance, *Pyracantha crenulata* has significant horticultural potential. Its aesthetic appeal, coupled with its tolerance to various soil types and growing conditions, makes it a versatile choice for landscaping projects. Whether used as a hedge, screen, or standalone specimen, *Pyracantha crenulata* adds visual interest throughout the year, with its glossy foliage, profuse flowers, and vibrant berries [12].

As interest in sustainable gardening practices grows, *Pyracantha crenulata* emerges as a promising candidate for green spaces in both urban and rural settings. Its low maintenance requirements, drought tolerance, and ability to attract wildlife contribute to its suitability for eco-friendly landscaping initiatives. Furthermore, ongoing research and breeding efforts aim to enhance the ornamental qualities and resilience of *Pyracantha crenulata*, ensuring its continued relevance in contemporary horticulture. In this review, we delve into the botanical features, ecological roles, and horticultural applications of *Pyracantha crenulata*, aiming to provide a comprehensive understanding of this species' importance in both natural and cultivated environments. By synthesizing existing knowledge and highlighting research gaps, this review contributes to the appreciation and conservation of *Pyracantha crenulata* while inspiring further exploration of its ecological and horticultural potential [13].

Plant Profile: [1]

- **Botanical name:** *Pyracantha crenulata* (D,Don) M. Roemer
- **Common name:** Nepalese firethorn
- **Local name:** Ghingar
- **Kingdom:** Plantae
- **Phylum:** Anthrophyta
- **Class:** Magnoloipsida
- **Order:** Rosales
- **Family:** Rosacea
- **Genus:** *Pyracantha*
- **Species:** *Crenulata*

Plant Description [5]:

- *Pyracantha crenulata*, often known as Nepalese firethorn, is a Rosaceae family evergreen shrub with vivid red berries.
- It is frequently found in riparian, coastal scrub, prairie, and disturbed environments, as well as by Roadsides.



- Bright red berries and green foliage characterize *Pyracantha* species.
- *Pyracantha crenulata* is a perennial shrub that is widely spread in China and the Himalayas, from Sutlaj to Bhutan at an elevation of 800-2500 meters.
- In Uttarakhand, it grows in the range of 1000-2600m, extensively available in Uttarkashi, Chamoli, Nainital, and Pithoragarh district.

Botanical Features [4]:

Pyracantha crenulata, commonly known as Nepalese firethorn or Himalayan firethorn, is a striking evergreen shrub celebrated for its distinctive botanical characteristics. Understanding its morphology and botanical features is essential for recognizing and appreciating this species in natural habitats and cultivated landscapes.

- **Morphology:** *Pyracantha crenulata* typically grows as a robust, densely branched shrub, reaching heights ranging from 1.5 to 3 meters. Its growth habit is compact and upright, forming a dense thicket of branches adorned with glossy foliage. The branches are often armed with sharp thorns, providing protection against browsing animals and contributing to its common name, “firethorn.”
- **Leaves:** The leaves of *Pyracantha crenulata* are one of its distinguishing features. They are dark green, glossy, and leathery in texture, providing an attractive backdrop for the plant’s flowers and berries. The leaves are typically elliptical to ovate in shape, measuring approximately 2 to 5 centimetres in length. One notable characteristic of *Pyracantha crenulata* leaves is their finely toothed margins, which give them a crenulated appearance, hence the specific epithet “crenulata.”
- **Flowers:** During the spring season, *Pyracantha crenulata* bursts into a profusion of small, white flowers arranged in clusters known as corymbs. These clusters of flowers emerge at the tips of the branches and are highly attractive to pollinators such as bees and butterflies. The flowers are characterized by their five-petaled structure and delicate fragrance, further enhancing their ornamental appeal.
- **Fruits:** Following the flowering period, *Pyracantha crenulata* produces an abundance of vibrant berries, which are a highlight of its ornamental value. The berries start off green and gradually ripen to shades of red or orange, depending on the cultivar and environmental conditions. These berries persist on the plant throughout the fall and winter months, providing a striking contrast against the dark green foliage and serving as a valuable food source for birds and other wildlife [16].
- **Root System:** *Pyracantha crenulata* typically develops a fibrous root system, which aids in anchoring the plant in various soil types and provides stability against soil erosion. While the root system is not highly invasive, it is essential to provide adequate space for root development when planting *Pyracantha crenulata* in gardens or landscapes.
- **Thorns:** One of the notable defensive features of *Pyracantha crenulata* is its sharp thorns, which are present along the branches. These thorns serve as a deterrent to browsing animals and help protect the plant from damage. While they may pose a challenge during pruning or maintenance activities, they contribute to the plant’s resilience and ability to thrive in various environments [18].

Overall, the botanical features of *Pyracantha crenulata* contribute to its ornamental appeal, ecological significance, and horticultural potential. Its dense foliage, showy flowers, colourful berries, and resilient growth habit make it a valuable addition to gardens, parks, and other



green spaces, enriching the landscape with its beauty and functionality.

Ecological Significance:

Pyracantha crenulata, or Nepalese firethorn, plays a vital role in supporting biodiversity and ecosystem functions in its native habitats and beyond. Understanding its ecological significance sheds light on its contributions to ecosystem health, wildlife habitat, and overall ecosystem resilience.

- **Habitat Provider:** *Pyracantha crenulata* serves as a valuable habitat provider for various wildlife species, including birds, insects, and small mammals. The dense foliage of the shrub provides cover and shelter, offering refuge from predators and harsh weather conditions. Birds, in particular, utilize *Pyracantha crenulata* as nesting sites, building their nests among the thorny branches to protect their offspring from potential threats [11].
- **Food Source:** The berries of *Pyracantha crenulata* are rich in nutrients and serve as an important food source for birds, especially during the fall and winter months when natural food supplies may be scarce. Birds such as thrushes, waxwings, and robins are attracted to the vibrant berries, which provide essential energy for migration, winter survival, and breeding activities. By offering a reliable food source, *Pyracantha crenulata* contributes to the survival and well-being of various bird species, enhancing local biodiversity [9].
- **Pollinator Support:** The flowers of *Pyracantha crenulata* attract a diverse array of pollinators, including bees, butterflies, and other insects. These pollinators play a crucial role in the reproductive success of the plant by transferring pollen between flowers, facilitating fertilization and seed production. By supporting pollinator populations,

Pyracantha crenulata contributes to the maintenance of plant diversity and ecosystem stability, as well as the production of fruits and seeds that sustain wildlife populations.

- **Soil Stabilization:** *Pyracantha crenulata* helps stabilize soil and prevent erosion, particularly in areas prone to slope instability or disturbance. The extensive root system of the shrub binds soil particles together, reducing the risk of erosion caused by water runoff or wind. In addition, the dense growth habit of *Pyracantha crenulata* provides ground cover, minimizing soil exposure to erosive forces and promoting soil retention over time [15].
- **Wildlife Corridor:** In fragmented landscapes or areas undergoing habitat degradation, *Pyracantha crenulata* can serve as a wildlife corridor, facilitating movement and dispersal of wildlife species. The shrub's dense foliage and berry production attract birds and other animals, creating interconnected pathways for wildlife movement between fragmented habitat patches. By promoting connectivity between habitats, *Pyracantha crenulata* contributes to gene flow, population resilience, and overall ecosystem health.

Overall, *Pyracantha crenulata* plays a multifaceted role in supporting biodiversity and ecosystem functioning. From providing habitat and food for wildlife to enhancing pollination services and soil stability, this species contributes to the resilience and sustainability of natural ecosystems. Recognizing and conserving the ecological significance of *Pyracantha crenulata* is essential for preserving biodiversity and promoting ecosystem health in both natural and human-modified landscapes [23].

Phytochemistry:

Pyracantha crenulata, commonly known as Himalayan firethorn or Nepalese firethorn, is a species of shrub in the Rosaceae family native to



the Himalayan region, including Bhutan, China, India, Nepal, and Pakistan. While there might not be an extensive amount of literature specifically on the phytochemistry of *Pyracantha crenulata*, we can infer some potential compounds based on its taxonomic classification and related species.

Pyracantha crenulata leaves include phenols, flavonoids, glycosides, resin, tannins, triterpenes, polyphenol, alkaloid, sterol, and coumarins [7]. It was established what components of flavanols myricetin, quercetin, and kaempferol were present. Additionally, the ethoxy alcohol fractions of the alcoholic extracts of the leaves and fruits included quercetin-3-O- β -D-glucopyranoside, myricetin, lupeol, stigma sterol, bergapten, scopolamine, β -sitosterol-3-O- β -D-glucopyranoside, and petroleum ether, Botulinic acid [25,26].

Quercetin is one flavonoid that has antioxidant and anti-inflammatory properties. Quercetin lessens the clinical symptoms of arthritis by preventing the synthesis of inflammatory cytokines, reducing lipopolysaccharide-induced cyclooxygenase (COX-2) levels, and suppressing nuclear factor-kappa β (NF- κ β) and AP-1 activity. It stops the formation of synoviocytes and the recruitment of neutrophils and macrophages [27].

In general, plants in the Rosaceae family often contain various phytochemicals, including [3,31]:

1. **Triterpenoids:** Many plants in the Rosaceae family are rich in triterpenoid compounds, which are known for their diverse biological activities such as anti-inflammatory, antioxidant, and antimicrobial properties. Examples of triterpenoids found in related species include ursolic acid and oleanolic acid.
2. **Flavonoids:** Flavonoids are another common group of phytochemicals found in many plants, including those in the Rosaceae family. These compounds contribute to the coloration of flowers and fruits and also possess antioxidant and anti-inflammatory properties.

Examples include quercetin, kaempferol, and various glycosides [14].

3. **Phenolic compounds:** Phenolic compounds are widely distributed in plants and are known for their antioxidant properties. They include phenolic acids, such as gallic acid and caffeic acid, as well as flavonoids and tannins.
4. **Alkaloids:** While less common in the Rosaceae family compared to some other plant families, alkaloids can still be found in certain species. These nitrogen-containing compounds often have pharmacological effects.
5. **Tannins:** Tannins are polyphenolic compounds found in many plants, especially in fruits, leaves, and bark. They have astringent properties and can also have antioxidant effects.

Given its ecological and geographical context, *Pyracantha crenulata* may contain similar phytochemicals to those found in other members of the Rosaceae family, particularly those native to the Himalayan region. However, detailed studies specifically focusing on the phytochemistry of *Pyracantha crenulata* would provide more accurate information about its chemical composition and potential bioactivities [20,21].

Pharmacological Activities [6,29]:

Pyracantha crenulata, commonly known as firethorn, is primarily valued as an ornamental plant due to its attractive berries and dense foliage. While it has been used in traditional medicine in some regions, scientific research on its pharmacological activities is limited [32].

However, some studies have investigated its potential medicinal properties:

Antioxidant Activity: Using the 2,2-diphenyl-1-picrylhydrazyl radical (DPPH) approach, Oldoni et al. (2016) techniques were followed. An assessment was carried out on the antioxidant activity. After combining 0.3 mL of extract with 2.7 mL of DPPH (40 μ g/mL) methanolic solution,



the mixture was let to sit in the shade for one hour at 25°C. Two absorbance measurements were made for each extract: one at 517 nm after 1, 5, and ten minutes after every ten minutes until 60 minutes. The plant extracts were treated with methanol alone, in sample amounts equal to reference standards (blank). Over time, the sample's antioxidant activity rises as DPPH consumption rises. To determine the inhibitory concentration, or IC50, 50 µL of different extract concentrations were mixed with a 5 mL DPPH solution (in methanol). After 30 minutes of room temperature incubation, an absorbance measurement at 517 nm was made and compared to a blank [24,34].

Anti-inflammatory Effects: In order to assess the extracts' ability to reduce inflammation, each rat was given an injection of carrageenan that had been dissolved in distilled water beneath the skin, causing edema in the left hind paw. In the investigated animal model, *Pyracantha crenulata* extracts were demonstrated to have potent anti-inflammatory properties [15,22].

Anti- Bacterial Activity: The conventional antibacterial activity of plant extracts was evaluated using the disc diffusion technique. Crashes of methanol and chloroform were dissolved in DMSO to yield a supply of 80 mg/mL w/v.

The traditional method is the disc diffusion method. The bacterial inoculums were made with CLSI M7-A7 and the inoculums' turbidity was measured against the 0.5 McFarland standard, which had 1-2 x 10⁸ CFU/mL. Mueller Hinton Agar plates were prepared and then covered with 100 µl of bacterial inoculums. On agar plates containing 400, 550, 700, and 850 µg/mL w/v of leaf extract, the aseptic discs were placed. In this experiment, DMSO served as the negative control and ampicillin as the positive control. The plates were incubated at 37°C for a whole day [11].

Antidiabetic Potential: Some studies have investigated the potential antidiabetic effects of *Pyracantha* extracts, indicating possible blood sugar-lowering properties. This could be of interest in managing diabetes, although further research is necessary [19, 28].

Cardiovascular Effects: Some preliminary studies suggest that *Pyracantha* extracts may have cardiovascular benefits, such as lowering blood pressure or cholesterol levels. However, more research is needed to confirm these effects [30,33].

Wound Healing: Traditional uses of *Pyracantha* species suggest that they may have wound-healing properties. Compounds present in *Pyracantha crenulata* extracts could promote tissue repair, reduce inflammation, and prevent infection, thereby accelerating the healing process [35].

Gastrointestinal Effects: Certain plants, including *Pyracantha* species, have traditionally been used to relieve gastrointestinal complaints such as diarrhea, gastritis and peptic ulcers. Bioactive compounds in *Pyracantha crenulata* extracts may have gastroprotective effects, reducing inflammation and promoting healing of the gastric mucosa.

Hepatoprotective effect: Dose 0.2 ml/kg, p.o. carbon tetrachloride was used to induce hepatotoxicity in mice using the method described by Aghel et al. (2011). Four sets of five mice were created weighing 20–25 g b. weight animals Group 1 (positive group) was administered carbon tetrachloride. Olive oil was all that was given to Group 2, which was the CCl₄ solvent for the negative group. Three and four experimental groups received 800 mg/kg and mg/kg of carbon tetrachloride one hour after receiving the crude leaf and fruit extracts, respectively. P.O. 0.2 milliliters each dose. Then, on the sixth day, the animals were killed, bled and serum collected, while the levels of the enzymes aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were evaluated. These

metabolic parameters were measured spectrophotometrically using commercially available assay kits. Livers were immediately removed, weighed, preserved in 10% formalin, gradually dehydrated in 50–100 % ethanol, washed in xylene and embedded in paraffin. Sections 4–5 μm thick were created using hematoxylin and eosin (HandE) stain for photomicroscopic studies [35].

Neuroprotective effect: Neurodegenerative diseases such as Alzheimer's disease and Parkinson's disease are characterized by progressive degeneration of nerve cells. A number of plant extracts, including those from *Pyracantha* species, have been studied for their potential neuroprotective effects. Compounds in *Pyracantha crenulata* may have antioxidant and anti-inflammatory properties that may help protect nerve cells from damage and degeneration.

Immunomodulatory activity: The immune system plays an important role in the body's defense against infections and diseases. *Pyracantha crenulata* extracts may contain bioactive compounds that modulate the immune system by improving the immune response against pathogens or regulating excessive immune responses in autoimmune diseases.

Pain-relieving properties: Pain relief is an important medical need and certain plants are known to have pain-relieving properties. *Pyracantha crenulata* extracts may contain compounds that relieve pain by blocking pain signaling pathways or reducing inflammation at the site of injury or inflammation.

Antifungal activity: The antifungal activity was evaluated by the plate diffusion method. Each fungal strain was seeded equally on Sabouraud dextrose agar plates. A 24-hour culture of each bacterium and a 7-day culture of the injected fungus were used to inoculate sterile Sabouraud dextral agar at 45°C. After 7 days of cultivation at 25–28 °C, the diameter of the zones of inhibition

was measured on the fungal plates. Each CD has an extract on it.

Anti-Microbial Activity: The antibacterial activity of the isolates was evaluated using the agar plate punch test (Xu et al. 2002). The pathogenic bacteria used were *Sarcina lutea*, *Micrococcus tetragenus*, *Staphylococcus aureus*, *Bacillus cereus*, and *Bacillus subtilis*. To summarize, 500 $\mu\text{g}/\text{mL}$ of each compound was dissolved using DMSO. A 6 mm diameter well was then filled with a test organism suspension (1.5×10^9 cfu/mL; cfu is a unit of colony-forming units) after it had been perforated in an appropriate agar growth medium. Testing those with inhibition diameters greater than 10 mm allowed us to identify the lowest inhibitory concentration of each active ingredient. The minimum inhibitory concentrations (MICs) of compounds 1-4 against five terrestrial pathogenic bacteria were assessed using a two-fold dilution method (Xu et al. 2002). To get final concentrations ranging from 0.39 to 50.0 $\mu\text{g}/\text{mL}$, an aliquot of 5×10^5 cfu/mL of bacterial culture was added to 96-well microtiter plates. After the compounds were diluted twice in MH broth, 100 μL of the mixture was put into each well. The lowest dose that did not cause colony formation was tested after 18 hours of incubation at 37°C to find the minimum inhibitory concentration (MIC). Vancomycin hydrochloride was used as a positive control, and the obtained findings were compared to its range of 0.01–25.0 $\mu\text{g}/\text{mL}$ under the same circumstances [10,36].

Antiuroolithogenic activity: A research has been done to determine the Antiuroolithogenic property of the alcohol and juice extract of the fruit of *P. crenulata* against an ethylene glycol induced model in albino rats and to confirm the traditional medicinal use of the plant [37].

Memory Enhancer: A mixture of *Pyracantha* and Ginkgo (*Ginkgo biloba*) leaves was found to enhance brain cell activity and hence to enhance memory.

Antihypertensive activity: It is a properly set up truth in scientific technology that its culmination is powerful in curing hypertension. Its leaves also have antioxidant, immune-modulatory and anti-inflammatory properties. Undoubtedly it is quite effective in curing various diseases. A study was conducted at the Indian Defence Institute of Bio-Energy Research (DIBER) a constituent Institute of the Defence Research and Development Organization (DRDO), to observe the effect of a *Pyracantha* herbal formulation on hypertensive rats. The results of the study confirmed the positive antihypertensive effect of this beverage. It's important to emphasize that while these potential pharmacological activities are based on traditional uses and studies of related plants, further research specifically focusing on *Pyracantha crenulata* is needed to confirm these effects, identify active compounds, and understand their mechanisms of action. Additionally, the safety and efficacy of using *Pyracantha crenulata* for medicinal purposes require rigorous scientific investigation.

CONCLUSION

Pyracantha crenulata, also known as Nepal fireweed or Himalayan fireweed, is a botanical gem with ecological, horticultural and potential pharmacological applications. Its botanical features, such as lush foliage, vibrant flowers and colourful berries, not only add to its aesthetic appeal, but also help improve its ecological sustainability and horticultural potential. *Pyracantha crenulata* is an important part of natural ecosystems, providing habitat, food and support for animals, pollinators and soil stability. Its position as a habitat provider, food provider, and pollinator underscores its importance in maintaining biodiversity and ecosystem functioning in a changing landscape. *Pyracantha crenulata* also looks promising in horticulture with its visual appeal, tolerance to various growing conditions and low maintenance requirements. As

the interest in sustainable gardening methods grows, their possibilities for environmentally friendly landscape projects also become evident, which contributes to the development of sustainable and diverse green areas. Additionally, while preliminary studies suggest possible pharmacological effects such as antioxidant, anti-inflammatory and antibacterial properties, more research is needed to confirm these effects, identify the active ingredients and ensure the safety and effectiveness of medicinal use. In summary, the study of the botanical characteristics, ecological roles and horticultural uses of *Pyracantha crenulata* highlights its importance in both wild and cultivated habitats. Valuing and preserving this species not only improve our environment, but also helps preserve biodiversity and sustainably manage ecosystems. *Pyracantha crenulata* is a monument to nature's beauty, resilience and both ecological and human well-being as we continue to realize its full potential.

REFERENCE

1. Chauhan NS. Medicinal and aromatic plants of Himachal Pradesh. Indus publishing; 1999.
2. Osmaston AE. A forest flora for Kumaon. Superintendent, Government Press, United Provinces; 1927.
3. Sarla Saklani SS, Subhash Chandra SC. Preliminary phytochemical evaluation of Garhwal Himalaya wild edible fruit *Pyracantha crenulata*.
4. Brandis D. Indian trees: an account of trees, shrubs, woody climbers, bamboos and palms indigenous or commonly cultivated in the British Indian Empire. Constable; 1906.
5. Gamble JS. A manual of Indian timbers. Рипол Классик; 1881
6. Khare CP, editor. Indian herbal remedies: rational Western therapy, ayurvedic, and other traditional usage, Botany. Springer science & business media; 2004.



7. Khare CP. Indian medicinal plants: an illustrated dictionary. Springer Science & Business Media; 2008 Apr 22.
8. Pande PC, Tiwari L, Pande HC. Ethnoveterinary plants of Uttaranchal—A review.
9. Sarla Saklani SS, Subhash Chandra SC, Mishra AP. Evaluation of nutritional profile, medicinal value and qualitative estimation in different parts of *Pyrus pashia* *Ficus palmata* and *Pyracantha crenulata*.
10. Saklani S, Chandra S. In vitro antimicrobial activity, nutritional value, antinutritional value and phytochemical screening of *Pyracantha crenulata* fruit. *International Journal of Pharmaceutical Sciences Review and Research*. 2014;26(1):1-5.
11. Simoons FJ. Food in China: a cultural and historical inquiry. crc Press; 2014 Mar 18.
12. Dimitri MJ. Enciclopedia de agricultura y jardinería. ACME. 1972;1.
13. Negi PS, Singh R, Bhakuni DS, Ahmed Z. *Crataegus*: A multipurpose plant of Himalayan hills. Technical pamphlet, DIBER (DRDO) Haldwani. 2009.
14. Peschel W, Bohr C, Plescher A. Variability of total flavonoids in *Crataegus*—factor evaluation for the monitored production of industrial starting material. *Fitoterapia*. 2008 Jan 1;79(1):6-20.
15. OTSUKA H, FUJIOKA S, KOMIYA T, GOTO M, HIRAMATSU Y, FUJIMURA H. Studies on anti-inflammatory agents. V. A new anti-inflammatory constituent of *Pyracantha crenulata* roem. *Chemical and Pharmaceutical Bulletin*. 1981 Nov 25;29(11):3099-104.
16. Kala CP. Prioritization of cultivated and wild edibles by local people in the Uttaranchal hills of Indian Himalaya.
17. Weber E. Invasive plant species of the world: a reference guide to environmental weeds. Cabi; 2017 Apr 13.
18. Kunkel G. Plants for human consumption; an annotated checklist of the edible phanerogams and ferns.
19. Walker AF, Marakis G, Simpson E, Hope JL, Robinson PA, Hassanein M, Simpson HC. Hypotensive effects of hawthorn for patients with diabetes taking prescription drugs: a randomised controlled trial. *British Journal of General Practice*. 2006 Jun 1;56(527):437-43.
20. Bahuguna YM, Chakraborty GS. Phytochemical examination of fruits of *Pyracantha crenulata* (D. Don) M. Roemer. *International Journal of Advances in Pharmaceutical Research*. 2014;5(5):267-73.
21. Singh H, Lily MK, Dangwal K. Evaluation and comparison of polyphenols and bioactivities of wild edible fruits of North-West Himalaya, India. *Asian Pacific Journal of Tropical Disease*. 2015 Nov 1;5(11):888-93.
22. OTSUKA H, FUJIOKA S, KOMIYA T, GOTO M, HIRAMATSU Y, FUJIMURA H. Studies on anti-inflammatory agents. V. A new anti-inflammatory constituent of *Pyracantha crenulata* roem. *Chemical and Pharmaceutical Bulletin*. 1981 Nov 25;29(11):3099-104.
23. Quiroga OE, Bou SM, Sarlingo CI, Nolasco SM. Study of the composition of *Pyracantha crenulata* roem seed, oil and meal. *Grasas y aceites*. 2003 Dec 30;54(4):335-8.
24. Pal RS, Kumar RA, Agrawal PK, Bhatt JC. Antioxidant capacity and related phytochemicals analysis of methanolic extract of two wild edible fruits from north western Indian Himalaya. *Int J Pharm Bio Sci*. 2013 Aug 28;4(2):113-23.
25. Quattrocchi U. CRC world dictionary of medicinal and poisonous plants: common

- names, scientific names, eponyms, synonyms, and etymology (5 Volume Set). CRC press; 2012 May 3.
26. Polunin O, Stainton A. *Flowers of the Himalayas*: Oxford University Press. New Delhi, India. 1984:79.
 27. Shah S, Tewari B, Bisht S, Tewari A. Seed maturation indicators in *Pyracantha crenulata* Roxb. in Kumaun central Himalaya. *New Forests*. 2006 Jul;32:1-7.
 28. Andrade-Cetto A, Heinrich M. Mexican plants with hypoglycaemic effect used in the treatment of diabetes. *Journal of ethnopharmacology*. 2005 Jul 14;99(3):325-48.
 29. Kumar D, Arya V, Bhat ZA, Khan NA, Prasad DN. The genus *Crataegus*: chemical and pharmacological perspectives. *Revista Brasileira de Farmacognosia*. 2012;22:1187-200.
 30. Singh R, Negi PS, Dwivedi SK. Indian hawthorn (*Pyracantha crenulata*). *New Age Herbals: Resource, Quality and Pharmacognosy*. 2018:135-49.
 31. Joshi RK, Laurindo LF, Barbalho SM. Chemical components and bioactivities of *Pyracantha crenulata* (D. Don) wild and cultivated from Uttarakhand, India: A review. *American Journal of Essential Oils and Natural Products*. 2022;10(1):34-7.
 32. Jasim ST, Saleh AH. PHARMACOLOGICAL ROLES OF *Crataegus SPECIES*. *Pakistan Journal of Biotechnology*. 2020 Sep 25;17(3):155-9.
 33. Tassell MC, Kingston R, Gilroy D, Lehane M, Furey A. Hawthorn (*Crataegus spp.*) in the treatment of cardiovascular disease. *Pharmacognosy reviews*. 2010 Jan;4(7):32.
 34. Sokół-Łętowska A, Oszmiański J, Wojdyło A. Antioxidant activity of the phenolic compounds of hawthorn, pine and skullcap. *Food chemistry*. 2007 Jan 1;103(3):853-9.
 35. Chang Q, Zuo Z, Harrison F, Chow MS. Hawthorn. *The Journal of Clinical Pharmacology*. 2002 Jun;42(6):605-12.
 36. Güven K, Yücel E, Cetintaş F. Antimicrobial activities of fruits of *Crataegus*. and *Pyrus*. *Species. Pharmaceutical biology*. 2006 Jan 1;44(2):79-83.
 37. Bahuguna YM, Rawat MS, Juyal V, Gusain K. Evaluation of *Pyracantha crenulata* Roem for antiurolithogenic activity in albino rats. *African journal of urology*. 2009;15(3).

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