

Wild Edible Ferns Underutilized Vegetable of Sikkim Himalayas

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SUMMARY

Edible ferns are one of the most significant underutilized plant resources of the Sikkim Himalaya where they have been traditionally included in the food systems of indigenous communities since long. These wild pteridophytes are rich in proteins, vitamins, minerals, dietary fibre and bioactive compounds and provide nutritional, medicinal, ethnobotanical and economic benefits. This article provides an overview of the diversity of edible ferns of Sikkim, their traditional classification and local nomenclature, nutritional composition, phytochemical profile, ethnobotanical importance and conservation concerns.

INTRODUCTION

Ferns and fern allies, collectively known as pteridophytes, are vascular cryptogamic plants that reproduce through spores. India harbours approximately 67 families, 191 genera, and more than 1,000 species of pteridophytes, with the highest diversity occurring in the Himalayan region, including North-East India and the Eastern and Western Ghats. Recent studies have highlighted the importance of edible ferns as underutilized vegetable resources, particularly in North-East India, owing to their nutritional and ethnobotanical significance (Giri and Uniyal, 2022). Although the Sikkim Himalaya occupies only about 0.2% of India's geographical area, it forms part of the Himalayan Biodiversity Hotspot and is recognized as one of the country's richest centres of plant diversity (Kholia, 2010). A total of 190 wild edible plant species has been documented from the Sikkim Himalaya, of which nearly 47 species are traded in local markets (Sundriyal and Sundriyal, 2004).

Among the diverse flora of the Sikkim Himalaya, pteridophytes constitute one of the most abundant plant groups. Several fern species are consumed as wild edible vegetables and serve as inexpensive yet highly nutritious food resources (Chettri *et al.*, 2024). They are rich in proteins, vitamins, minerals, dietary fibre, and a wide range of bioactive compounds and secondary metabolites that contribute to their nutritional and medicinal value (Kapoor *et al.*, 2022). Naturally occurring edible ferns form an integral part of the traditional Himalayan diet and also provide an important source of seasonal income for rural communities (Sundriyal and Sundriyal, 2004). Their consumption not only improves dietary diversity but also enhances nutritional security by supplementing staple food crops.

In recent years, edible ferns have attracted considerable scientific attention because of their nutritional composition, medicinal properties, ornamental value, potential for in vitro propagation, and phytoremediation applications. These attributes highlight the importance of conserving and sustainably utilizing edible fern resources while promoting their cultivation and value addition for improved food security and rural livelihoods (Chettri *et al.*, 2024).

2. Traditional classification and local nomenclature

In Sikkim, edible ferns are popularly known as "Ningro." However, the nomenclature of these edible species is often ambiguous, with no clear distinction among several local names (Kholia, 2010). Indigenous communities traditionally identify and classify edible ferns based on a combination of characteristics such as altitude, colour of the fiddleheads, mucilage secretion, taste, texture, and season of availability. Although these traditional naming systems are widely practiced, they are not always applied consistently and may vary among local communities. These five subheadings are mostly used to determine the names assigned to the fern.

- 1) Altitude: Edible ferns found in tropical and subtropical climates are referred to as "hot areas" (awley ningro) and "cold areas" (lekh ningro), occasionally "dhure ningro" (dhure meaning mountain top).
- 2) Color of fiddle head: *Tectaria coadunata* reddish or pink fiddle heads are dubbed rato ningro, light green or whitish fiddleheads are called seto ningro, and ferns with black fiddle heads are named kalo or kali ningro in addition to the common and most used *Diplazium* species.

- 3) Mucilage secretion: Chipley ningro are edible ferns that have a high level of mucilaginous secretion when they are chopped and plucked. In addition, edible ferns known as Chipley ningro have a glossy, thick cuticle and a glossy upper surface.
- 4) Flavor: Tetey ningro refers to ferns with a bitter flavor. (*Diplazium spectabile*)
- 5) Hardness and thickness of fiddleheads: ningro with firm stick fiddleheads, such as *Diplazium himalayensis*, are occasionally referred to as danthey ningro, and ningro with thin, herbaceous, loose fiddleheads, such as kuthurkey *Dryopteris cochleata*, *Athyrium schimperi*, etc.
- 6) Month of Availability: Occasionally, ningro are also called after the months that they are available, for example, bhadore ningro, shrawane ningro, etc. (named after the names of Hindu calendar months, Shrawan and Bhado or Bhadrapada). As a result, the traditional name, auley Chipley ningro, is a mixture of two or more characters, such as *Diplazium esculentum*. *Diplazium dilatatum*, however, is referred to as lekh Chipley ningro.

3. Nutritional composition and medicinal importance

The nutritional values and mineral content of wild edible plants were found to be richer than some of the commercial vegetables and it can be used for nutritional purpose (Seal 2012). The edible ferns are nutritionally important and are traditionally used as supplements to the staple grain-dominated diets and agricultural crops that are only seasonally available. It can thus raise rural people's nutritional intake by providing a year-round supply of food. As per the findings of Chettri *et al.*, (2018) on nutritional status of six wild edible ferns, *Tectaria coadunata* is a good protein supplement with 12.10 % and *Diplazium maximum* is a source of vitamin C with 25.38mg/100g apart from other nutrients. *Diplazium esculentum* an edible fern collected from the Sikkim Himalayas was analyzed for proximate and mineral composition and the result concluded that it is a rich source of protein, carbohydrate and vitamin C content (Pradhan *et al.*, 2015). Wild plants serve as an indispensable constituent of human diet supplying the body with minerals, vitamins and certain hormone precursors, in addition to protein and energy. These plants offer certain beneficial products, such as like medicine, fodder, fibre, etc. The study of wild vegetable is important not only to identify the potential sources which could be utilized as alternative food but also to select promising types for domestication (Seal 2012). The nutrient content of few of the leafy vegetables disclosed that some of the greens contained comparatively higher amounts of crude protein.

The wild edible plants ferns and its allies are expected to have many useful secondary metabolites than other plants. Ferns were reported to have many useful phytochemicals (secondary metabolites) such as flavonoids, steroids, alkaloids, phenols, triterpenoid compounds, varieties of amino acids and fatty acids (Zeng-fu *et al.*, 2008). Huperzine A, an alkaloid, isolated from *Huperzia* species and other members of Lycopodiaceae, has been shown to enhance memory in animals and is also being looked into as a potential therapy for treatment of Alzheimer's disease. Several studies have reported the presence of leucocyanidin, leucodelphinidin, the flavone ester apigenin 7-O-p-hydroxybenzoate in *Pteris vittata* L. (Imperato, 2006). Such economically important ferns are generally collected from the forest for commercial exploitation.

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. Ethnobotany of the fern and fern allies

Ethnobotanical studies have demonstrated that edible ferns are valuable sources of food, medicine, livestock resources, and traditional knowledge across the Himalayan region and other parts of Asia. Species such as *Diplazium esculentum*, *Diplazium maximum*, and *Dryopteris cochleata* are widely consumed as seasonal vegetables and are also used in traditional medicine for treating ailments including dysentery, cough, haemoptysis, snakebite, leprosy, rheumatism, and bone fractures (Kumari *et al.*, 2011; Rai and Lalramnghinglova, 2010). In Sikkim, *D. esculentum* (locally known as *unew*) has multiple ethnobiological uses, serving as a popular leafy vegetable, cattle bedding, incubation material, and a source of organic manure highly valued for ginger and vegetable cultivation (Pradhan *et al.*, 2015). Similarly, in central Nepal, *D. esculentum* was identified as one of the highest-priority wild vegetables for future domestication because of its nutritional, socio-economic, and cultural importance (Joshi *et al.*, 2015). Edible ferns are particularly important in the North-Eastern Himalayan region, where they contribute significantly to household nutrition, food security, livelihoods, and cultural heritage (Giri *et al.*, 2022). Biochemical analyses have further confirmed the nutritional richness and strong antioxidant properties of several edible fern species, highlighting their potential as functional foods (Tag *et al.*, 2014). In China, edible ferns have been consumed for over 3,000 years, with numerous species documented for their food value, chemical composition, and cultivation potential, underscoring their importance as sustainable wild food resources (Liu *et al.*, 2012). Collectively, these studies emphasize the multifaceted ethnobotanical significance of ferns and support

their conservation, sustainable utilization, and domestication for enhancing nutrition, healthcare, and rural livelihoods.

5. Conservation

The pteridophytes are dependent on the microclimatic conditions of the region for their successful survival in the region. Any disturbance can hinder the evolutionary process leading to their population decline. Climate change, industrialization, encroachment on forest lands, over-exploitation of natural resources, and large-scale collection of ferns from forests by visitors and locals for ornamental, culinary, and medicinal purposes all pose significant threats to the survival of these groups of plant. Several edible fern species are becoming scarce in nature due to rising demand. The rules of sustainable utilization are not followed during collection of fern fiddleheads (Kholia, 2010). It was recorded that plant dwellers have open access for the collection of these plant resources, which often leads to their over exploitation (Sundriyal and Sundriyal, 2004). Conservation approaches like propagation can play a vital and complementary role in guaranteeing the survival of these species by providing genetic resources from wild populations (Marimuthu and Manickam, 2011)

CONCLUSION

This article highlights the diversity, nutritional value, ethnobotanical importance, and conservation status of wild edible ferns of the Sikkim Himalaya, locally known as Ningro. These underutilized wild vegetables are rich in proteins, vitamins, minerals, and health-promoting phytochemicals, making them valuable resources for nutrition, food security, and rural livelihoods. The article also emphasizes the rich indigenous knowledge associated with the identification and utilization of edible ferns, their traditional medicinal uses, and their economic significance for local communities. Despite their immense potential, increasing pressure from overharvesting, habitat degradation, and climate change threatens their natural populations. Sustainable harvesting, conservation, propagation, value addition, and domestication of economically important edible fern species are therefore essential for preserving this unique natural heritage. The article underscores the need to conserve and promote these underutilized vegetables to strengthen biodiversity conservation, nutritional security, and sustainable livelihood opportunities in the Himalayan region.

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