

## Potentiality of Underutilized Horticultural Crops of Sikkim

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### Abstract

Horticultural crops can be considered underutilized since they are neither widely traded nor farmed on a big scale for economic purposes. Local people grow, trade, and eat these crops. Their level of popularity varies from crop to crop and from area to area, but it can be increased significantly through exposure. Horticultural crops that are not used enough have numerous benefits. These are naturally hardier and simpler to cultivate, yielding a crop even under unfavorable soil and weather circumstances. The majority of them are extremely abundant in vitamins, minerals, and other nutrients including lipids, proteins, and carbs. Due to their long history of usage, the underutilized horticulture crops have been known to have nutritional and therapeutic benefits to the local population. Furthermore, because they are not a part of the organized market, they are inexpensive and easily accessible. There are a number of obstacles that underutilized crops must overcome, including a lack of knowledge about their nutritional and financial worth, a lack of organized markets, a lack of good communication, a lack of research funding, a shortage of high-quality planting materials, a lack of technical expertise, and inadequate extension services. In addition to increasing exports of fresh horticulture crops and seed, these horticultural crops' increased area and productivity will promote nutritional security and reduce import costs, so bolstering the local economy. This article deals with some of the commonly available underutilized horticultural crops in Sikkim.

### Introduction

Being home to over 70% of farming households worldwide, India constitutes one of the most populated countries in the world, making up over one-fifth of all people. While the overall need for food is predicted to rise by 3% or more annually in the near

future, the population is only growing at a rate of about 1.8% annually. While over 60 cultivated and roughly 30 less commonly recognized vegetable crops can be grown in India due to its unique agroclimatic conditions, underused veggies have received little attention. Species of plants or crops that are underutilized are "those with underexploited potential for promoting food security, health (nutritional/medicinal), income generation, and environmental services" (Jena *et al.*, 2018). Sikkim is a haven for botanists. It has 26% of the nation's flowering plants, or over 4500 species, making it rich in biodiversity aspects. There are also 450 kinds of trees, 36 types of rhododendrons, 480 species of orchids, and 424 classified medicinal herbs. Of these, sixty-five plant species are endangered or threatened. The State should give special consideration to the protection of these species and their natural habitats (Kumar *et al.*, 2013).

### Importance of underutilized horticultural crops

Millions of tribal groups could benefit from the increased use of underutilized horticulture crops, which are vital biological resources for the rural poor. They have significant levels of antioxidant activity and are abundant in vitamins, minerals, and other elements that are good for your health. They are crucial in the diet's diversity, which produces a more balanced supply of micronutrients. Improved utilization of these can result in improved nutrition. By strategically concentrating on underutilized horticultural crops, it is possible to prevent dietary deficiencies, including micronutrient shortages, and to promote a varied and balanced diet, which is especially important for impoverished rural communities and other socially disadvantaged groups in developing nations. Moreover, they exhibit strong resilience to many biotic and abiotic stressors. Horticultural crops that are underutilized have a significant impact on rural communities. They can

help eradicate poverty by creating jobs and revenue, as well as by increasing the profitability and efficiency of farm household labor in both rural and urban settings. The risk of being overly dependent on a small number of important crops can be decreased by using these crops. Additionally, by increasing food edibility options, they can support sustainable livelihoods through household food security. In order to satisfy growing market demands and enhance productivity and security of food worldwide, they can also offer a wide variety of crops (Bhutia *et al.*, 2023a). Following are some of Sikkim's underutilized horticultural crops:

**Bee (*Solanum aethopicum* and *Solanum macrocarpum*)**

It is locally referred to as sano and thulo bee respectively and commonly as eggplant. Phytochemical screening showed the presence of alkaloids, flavonoids, phytosterols, saponins, ascorbic acid, cardiac glycosides, tannins, and terpenols in the two species of garden eggs. Generally speaking, *S. aethopicum* L. was found to have more phytochemicals than *S. macrocarpum* L. Vitamins including tocopherol, retinol, thiamine, riboflavin, niacin, ascorbic acid, and calciferol have also been documented (Han *et al.*, 2021). This plant has numerous useful dietary qualities because of its significant therapeutic value. Nutraceuticals and nutritional supplements containing its saponins are significant. They shield plants from microbial diseases and have antibacterial qualities. The fruits and stalk of the plant have been shown to contain flavonoids and ascorbic acid, both of which have a significant potential for antioxidant activity (Diatta *et al.*, 2020). The softened and crushed fruits have additional uses as a purgative. Crushed leaves are used to cure stomach problems, while the juice from boiling roots is used to treat hookworms. Many plant parts are used in decoction form to treat a variety of illnesses, including diabetes, cholera, otitis media, toothaches, bronchitis, skin infections, dysuria, asthenia, dysentery, and hemorrhoids. Moreover, studies on eggplants' phytochemical content have shown that they have antiviral, anticancer, anticonvulsant, and anti-infective properties. Eggplants are also said to have narcotic, anti-asthmatic, and antirheumatic properties (Abubakar *et al.*, 2021).

**Ningro (*Diplazium esculentum*)**

*Diplazium esculentum* belongs to the Athyraceae family and is locally referred to as Ningro in Sikkim. In Sikkim, this vegetable is particularly well-liked during the monsoon season. The young, cooked fronds (circinately coiled) of *Diplazium esculentum* are consumed as a vegetable by the ethnic people of Sikkim. It can be made either way, with or without potatoes or chhurpi, a food that resembles cottage cheese. The aggressive fern *Diplazium esculentum* grows in wasteland, forests, and undisturbed places next to farms and forests. It usually thrives in areas that are shaded and moist (Bhutia *et al.*, 2023a). The various communities in India and other countries have traditionally used this plant to treat a wide range of illnesses, including asthma, dysentery, wounds, high blood pressure, constipation, fever, skin related diseases, smallpox, rheumatism, etc. (Essien *et al.*, 2019). In addition, India's tribal and rural populations gather this species in great quantities and sell it to improve their standard of living (Sarkar *et al.*, 2018). The presence of alkaloids, flavonoids, glycosides, polyphenols, tannins, terpenoids, steroids, carbohydrates, lipids, and oils in various solvent systems was discovered through literature-based screening for *D. esculentum*'s bioactive components (Sarkar *et al.*, 2018; Naik *et al.*, 2021). Among *D. esculentum*'s functional attributes, the plant's immune-modulatory, antidiabetic, antibacterial, antioxidant, and anti-inflammatory actions may contribute to its pharmacological and preventative benefits (Semwal *et al.*, 2021).

**Nakima (*Tupistra clarkei*)**

*Tupistra clarkei* commonly referred to as nakima in the local tongue belongs to the Asparagaceae family. It is a perennial crop that grows in home gardens as well as in the wild. It favors wet, shaded environments. It is a seasonal flowering plant that flowers and fruits during September to October and November to December, respectively. The inflorescence of this vegetable is edible and is prepared like a vegetable. Along with secondary metabolites that have antibacterial, antioxidant, and antidiabetic properties, it is incredibly rich in nutrients and minerals. As such, it has immense promise for the creation of novel medications in the fields of pharmacology and

medicinal chemistry (Bhutia *et al.*, 2023b). Because of its lower sodium/potassium ratio, "nakima" is a nutraceutical meal that is suggested to lower high blood pressure (Pradheep *et al.*, 2020).



**Fig.1. (a) Bee, *Solanum macrocarpum*; (b) Ningro, *Diplazium esculentum*; (c) Nakima, *Tupistra clarkei*; (d) Totola, *Oroxylum indicum***

The recent rise in popularity of "nakima" among consumers can be attributed to its medicinal benefits. The herb has many traditional and native medicinal applications. Powdered root and flower decoction, along with dried flower, is used as a tonic for pain relief and as a means of controlling diabetes (Lepcha *et al.*, 2019). Flowers make a delicious appetizer and are a great source of secondary metabolites. Verma and Nath (2016) suggested that flowers may provide a natural antioxidant that could help prevent degenerative disorders linked to oxidative stress.

#### **Totola (*Oroxylum indicum*)**

*Oroxylum indicum*, commonly referred to as the Indian Trumpet tree, is a small to medium-sized deciduous tree that grows in the Bignoniaceae family and is native to the Asian subcontinent. It is referred to locally as Totola. The majority of the tree's parts are used in traditional Ayurvedic medicine to cure and prevent a number of illnesses, such as diabetes, stomach ulcers, rheumatoid arthritis, and jaundice (Dinda *et al.*, 2015). The flower's edible portion is consumed like cooked vegetables. The plant *Oroxylum*

*indicum* contains many compounds, such as flavonoids, alkaloids, tannins, glycosides, saponins, phenols, and quinones, in its various portions. The main components of storage are flavonoids, which include chrysin, oroxylin-A, baicalein, and baicalein-7-O-diglucoside. According to Dinda *et al.* (2015), *Oroxylum indica* and its constituents have a variety of biological activities, such as antibacterial, antihyperglycemic, anticancer, cardioprotective, analgesic, antioxidant, and anti-inflammatory properties. Additionally, neuroprotective and anti-epileptic properties have been discovered for it.

#### **Conclusion**

A wide variety of underutilized horticultural crops with high nutrient potential, therapeutic qualities, and resistance to harsh weather may be found in Northeastern India. Unfortunately, despite their potential, these underutilized horticultural crops continue to be ignored because of a lack of information about their capabilities and input needs, a lack of planting materials, a lack of understanding about how to incorporate them into production systems, and a lack of native crop production, unlike the major cultivated crop species. Northeastern India boasts an abundance of underutilized horticultural crops that are high in nutritional value, possess therapeutic qualities, and can withstand harsh weather conditions. Nonetheless, these underutilized horticultural crops continue to be disregarded because there is a lack of comprehensive information regarding their capabilities and input needs, planting supplies, integration into production systems, and native crop production, in contrast to the major cultivated crop species. To secure food and nutritional security for the future, it is imperative to launch a program on genetic resources investigation, administration, usage, and enhancement of these underutilized horticultural crops. In addition, the production of underutilized horticultural crops will address the lack of availability for per capita consumption, helping to address the nutritional deficit. It will also create jobs, raise rural residents' incomes, and ultimately strengthen the national economy.

#### **References**

Abubakar, A.R., Sani, I.H., Malami, S., & Yaro, A.H. (2021). Anxiolytic and sedative activities of



- methanol extract of *Solanum aethiopicum* (Linn.) fruits in Swiss mice. Journal of Natural Products, 5, 353-358
- Bhutia, T. L., Devi, E. L., Dutta, S. K., Das, S. K., Kumar, A., Saha, S., Devadas R., & Laha, R. (2023a). Potential of underutilized vegetables of Sikkim for future breeding. In: Laha, R., Das, S.K., Devadas, R. *et al.* Winter School Training Manual on Advances in the Organic Production System in Sikkim Himalayas. ICAR Research Complex for NEH Region, Sikkim Centre, Tadong, Gangtok, pp. 85-89.
- Bhutia, T.L., Dutta, S.K., Devi, E.L., Das, S. K., & Kumar, A. (2023b). *Tupistra clarkei*: Medicinally rich lesser-known vegetable of Sikkim Himalayas. Food Science Reports, 4 (6), 46-51.
- Dhungel, R. (2021). [https://twitter.com/Rozan\\_Dhungel/status/1441673686814052357](https://twitter.com/Rozan_Dhungel/status/1441673686814052357). Accessed on 12.02.2024.
- Diatta, K., Diatta, W., Dior Fall, A., Mbacké Dieng, S.I., Ibrahima Mbaye, A., Sarr, A., & Adjoke Adegbindin, M. (2020). Evaluation of the Antioxidant Activity of Stalk and Fruit of *Solanum aethiopicum* L. (Solanaceae). Asian Journal of Research in Biochemistry, 6(1), 6-12.
- Dinda, B., SilSarma, I., Dinda, M., & Rudrapaul, P. (2015). *Oroxylum indicum* (L.) Kurz, an important Asian traditional medicine: from traditional uses to scientific data for its commercial exploitation. Journal of ethnopharmacology, 161, 255-278.
- Essien, E.E., Ascrizzi, R., & Flamini, G. (2019). Characterization of volatile compounds of *Diplazium esculentum*. Chemistry of Natural Compounds, 55, 958-959.
- Han, M., Opoku, K.N., Bissah, N.A., & Su, T. (2021). *Solanum aethiopicum*: The nutrient-rich vegetable crop with great economic, genetic biodiversity and pharmaceutical potential. Horticulturae, 7(6), 126.
- Jena, A.K., Deuri, R., Sharma, P., & Singh, S.P. (2018). Underutilized vegetable crops and their importance. Journal of Pharmacognosy and Phytochemistry, 7(5), 402-407.
- Kumar, A., Avasthe, R. & Rahman, H. (2013). Potential and Prospects of Underutilized Horticultural Crops of Sikkim. In: Prakash, N., Roy, S.S., Sharma, P.K., & Ngachan, S.V. Developing the Potential of Underutilized Horticultural Crops of Hill Region, Today and tomorrow's printers and publishers, pp.257-285.
- Lepcha, T.T., Pradhan, P., Gaira, K.S., Badola, H.K., Shahid, M., & Singh, M. (2019). Ethnomedicinal use of plants by Bhutia tribe in Sikkim Himalaya. Proceedings of the 1st Himalayan Researchers Consortium, 1, 71-78.
- Naik, B., Maurya, V.K., Kumar, V., Kumar, V., Upadhyay, S., & Gupta, S. (2021). Phytochemical analysis of *Diplazium esculentum* reveals the presence of medically important components. Current Nutrition & Food Science, 17(2), 210-215.
- Pradheep, K., Lepcha, B., Rathi, R.S., Vikas, V.K., & Singh, P.K. (2020). "Nakima" (*Tupistra clarkei* Hook. f., Asparagaceae): a potential vegetable crop of Sikkim, India. Genetic Resources and Crop Evolution, 67, 1619-1626.
- Sarkar, B., Basak, M., Chowdhury, M., & Das, A. (2018). Importance of *Diplazium esculentum* (Retz.) Sw. (Athyriaceae) on the lives of local ethnic communities in Terai and Duars of West Bengal-A report. Plant Archives, 18(1), 439-442.
- Semwal, P., Painuli, S., Painuli, K.M., Antika, G., Tumer, T.B., Thapliyal, A., & Cho, W.C. (2021). *Diplazium esculentum* (Retz.) Sw.: ethnomedicinal, phytochemical, and pharmacological overview of the Himalayan ferns. Oxidative Medicine and Cellular Longevity, 2021.
- Verma, S., & Nath, L.K. (2016). Analytical Standards for the Flowers of *Tupistra nutans* Wall. - A Rare Medicinal Plant of Sikkim Himalayan Region. Scholar Research Library, 8(19), 48-56.

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