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Nutritional profile, phenolic composition, health benefits and applications of *Prunus nepalensis*: A review

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Abstract

Prunus nepalensis, locally known as sohiong is a fruit from the north-eastern region of India. It is rich in several vitamins and minerals and is also a storehouse of essential bioactive compounds. It is consumed fresh or converted into jams, squashes, and wines by the local people. It has immense potential to be processed into value added products on a commercial scale. It is both delicious and nutritious. Sohiong is also rich in β -carotene and vitamin C. It contains higher amount of sodium, iron, calcium, and crude fiber as compared to other fruits like peaches and berries. Being rich in vitamins and minerals, it can also be used as a dietary supplement to fulfil the daily nutrient requirement of the body. Scientific studies have also been done to investigate the ability of the fruit extracts to fight against serious diseases like breast cancer and iron induced hepatotoxicity. The impressive phytochemical profile makes the fruit a perfect option to prevent the development of diseases like diabetes, obesity, oedema, hypertension, and cardiovascular ailments. It can also be used for the preparation of several processed food products like candies, jams, squashes, and wines. The review discusses the various aspects of the fruit ranging from its geographical distribution, nutritional profile to its utilization on local and commercial scale.

Keywords: *Prunus nepalensis*, nutrients, bioactive, utilization

1. Introduction

Meghalaya has several underutilized and rare fruits which are not found in other parts of the country. One such fruit is *Prunus nepalensis* commonly known as Meghalaya's blackberry, Himalayan cherry or Sohiong. It is a member of the Rosaceae family (Rymbai *et al.* 2016) [16]. It is a delicious fruit with a characteristic taste and a nutritious profile. This fruit is famous locally but is not widely popular. It is consumed mainly by the local people of the rural areas. Sohiong is full of various vitamins, minerals, and large number of antioxidants. (Barua *et al.* 2019) [4] The fruit is used to prepare juices, jams, jellies as it has both- good taste and attractive color. The cultivation is confined to few areas, and they thrive in wild and semi wild environmental conditions. The fruits are cherry like round, with single stone seed, slightly green to pinkish initially and turn dark purple once ripened. The surface of the fruit is shiny and smooth just like black grapes. (Rymbai *et al.* 2016) [16]. It is found to have originated in the foothills of eastern Himalayas which include Nepal, Myanmar, and China. In India, it is found in Khasi and Jaintia in Meghalaya, Sibsava valley in Assam, Naga hills in Nagaland and certain areas of Arunachal Pradesh (Rymbai *et al.* 2016) [16]. This berry is a rich source of vitamin-C, phenolic compounds, flavonoids, and anthocyanin pigments. (Kashyap *et al.*, 2022) [12]. Because of the presence of these bioactive compounds (quinic acid, catechin, quercetin, reserpine, caffeoyl hexose, ascorbic acid, rutin, gallic acid and purpurin), Sohiong has high antioxidant and antimicrobial activity. (Kashyap *et al.*, 2021) [11]. The fruit can be consumed raw or can be processed into various value-added products like squash, jelly, and wine. The by-product of the processed fruit is pomace, which contains the skin, seed, and stems. The pomace is also rich in several phenolic compounds and can be used to extract these compounds for further utilisation. (Kashyap *et al.* 2022) [12] The fruits are also used as an astringent and its leaves have diuretic properties which can be used for the treatment of oedema. The berries are available between the months of August till December. It is also a rich source of fiber. (Murugkar and Subbulakshmi, 2005) [2] This fruit comes under the underutilised fruits category of India because of the lack of processing techniques and

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unavailable storage facilities. These reasons lead to the high post-harvest loss. The fruit is still unknown to people residing outside Meghalaya. Thus, it is important to ensure proper utilisation of this fruit. It not only is a potential source of essential nutrients but also a source of natural colourant. Some processed products like preserves and wines and prepared by the local people. It can also be used for the treatment of degenerative diseases like oedema and diuresis. (Vivek *et al.*, 2018) ^[18] The distinctive colour of the fruit is due to the presence of high amounts of anthocyanins. (Dash *et al.* 2021) ^[9]. The fruit is usually available in two distinct sizes- large and small, the larger ones having higher nutritional density. The underutilized fruits of sohiong are highly therapeutic because of the presence of several nutrients. Even then, they are limited to a small geographical area. The negligence of cultivation is visible on the scientific as well as farming level. (Lata *et al.* 2023) ^[20] With proper knowledge and increased cultivation of the fruit, the processed products of sohiong can also be made popular and common in everyday markets. *Prunus nepalensis* has gained considerable interest from researchers because of its high antioxidant and

phytochemical profile. This makes it a potential source to fight against a wide range of diseases. It is a storehouse of iron, β -carotene, and vitamin-C. Thus, it has the capability to be widely used in the pharmaceutical and food industry. The fruit can be dried and converted into powdered form so that it can be incorporated in various other food products. (Dash *et al.* 2021) ^[9] It can be grown easily in areas with cool climate. Sohiong can be used to extract natural edible colour which has various uses in the food industry. It has been scientifically observed that the extracted colour, when added to different processed products (jams, juices etc.), remains as it is up to a time duration of one year. Wines are prepared from the fruit as it gives the distinct purple colour which is a desirable factor in wines. (Rymbai *et al.* 2016) ^[16] Commercialisation of sohiong may provide excellent income and employment opportunities to the tribal who locally grow these fruits. Currently, no distinct varieties of the fruit are known. The fruit is differentiated only in the basis of its size- whether big or small. (Rymbai *et al.* 2016) ^[16]. This review focuses on the nutritional and phytochemical composition of the *Prunus nepalensis* fruit.

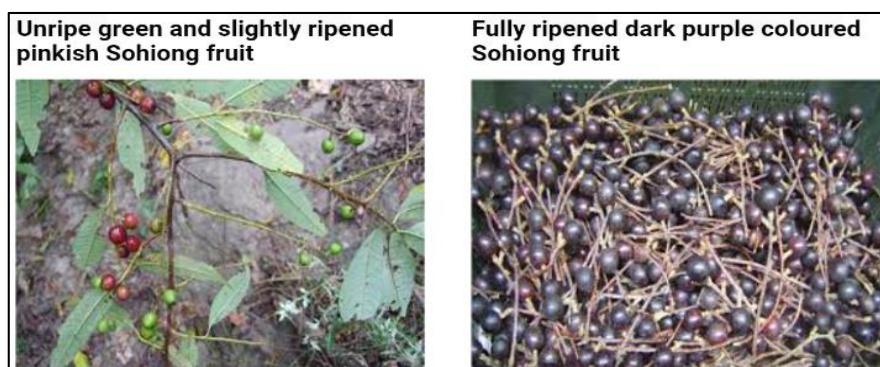


Fig 1: Unripe and ripened Sohiong fruits

2. General description, origin, and distribution

Prunus nepalensis is a species of the *Prunus* genus and is like plums, peaches, and cherries. It belongs to the Rosaceae family. It is a local fruit from the hills of Manipur and Meghalaya. It is also known as Himalayan cherry or Khasi cherry. It is known to have originated from the Eastern foothills of the Himalayas, including Myanmar, Nepal, and China. In India, it is found in the Dikho valley of Assam, Jaintia and Khasi hills of Meghalaya, Naga hills of Nagaland and Tawang and Dirang regions of Arunachal Pradesh.

(Rymbai *et al.* 2016) ^[16] The tree is of around 15-20 m in height, with upright growth and dark brown to greyish colored barks with open branches. Fruits are round with one stone (seed) and are green to pink colored in early stages. They later turn to blackish dark purple on ripening. The surface is shiny and smooth like black grapes. The flowering period is from November to March and harvesting is done from July to October. The sign of maturity is the dark color of the ripened fruits. On an average, a 13-year-old tree can produce 110-160 kg fruit per year. (Lata *et al.* 2023) ^[20]

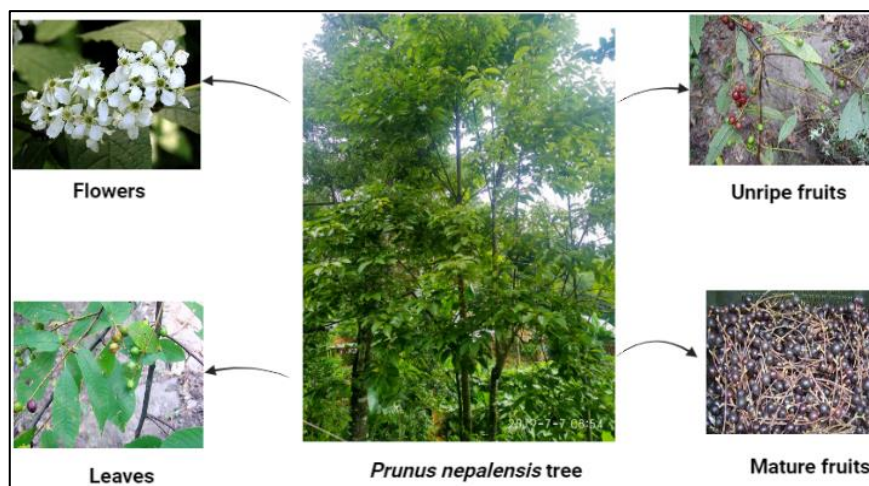


Fig 2: Sohiong tree and various parts

3. Physical characteristics

Fruits of different sizes (big and small) were collected from various parts of Jaintia and Khasi Hills at altitudes of 600m to 2000m and a temperature of 28° C. after proper washing, the physical characteristics were determined. (Rymbai *et al.* 2016) ^[16] Vernier calipers and weighing balance were used for measurements. The average porosity of Sohiong is around 0.46%. The average true density and bulk density is 1.190 and

0.592 g/cm³. The fruit is highly acidic. The glucose and fructose levels of the fruit are higher in comparison to the other varieties of peaches. (Vivek, Mishra, and Pradhan, 2018) ^[18] The fruit weight ranges from 3 to 7.91 g, specific gravity ranges from 0.94 to 0.95, fruit length and diameters from 17 to 21 mm, stone weight is usually from 1 to 2 g. (Rymbai *et al.* 2016) ^[16] Other characteristics have been shown in Table (1)

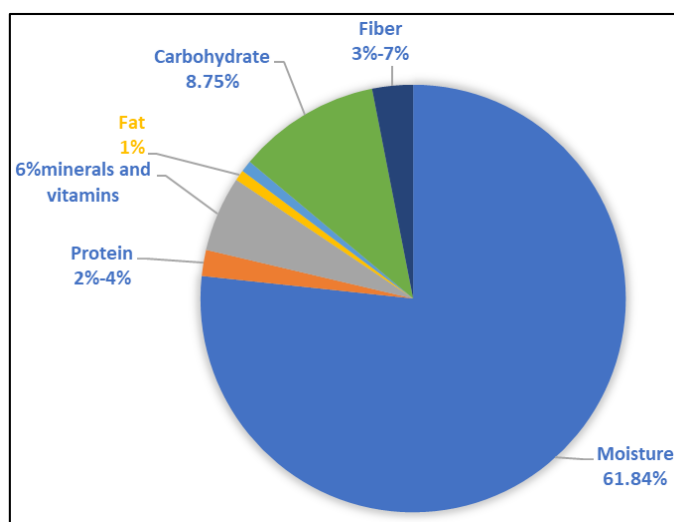
Table 1: Physical characteristics of Sohiong fruit

S.no.	Parameters	Value range	Reference
1	Weight (g)	3.98-7.91	Rymbai <i>et al.</i> 2016 ^[16]
2	Specific gravity	0.94-0.95	Rymbai <i>et al.</i> 2016 ^[16]
3	Fruit length (mm)	18.16-21.76	Rymbai <i>et al.</i> 2016 ^[16]
4	Fruit diameter (mm)	17.12-21.80 19.162 ± 3.755	Rymbai <i>et al.</i> 2016 ^[16] Dash <i>et al.</i> 2021 ^[9]
5	Stone weight (g)	1-2.44	Rymbai <i>et al.</i> 2016 ^[16]
6	Pulp recovery (%)	69.11-74.71	Rymbai <i>et al.</i> 2016 ^[16]
7	pH	3.4-3.8	Dash <i>et al.</i> 2021 ^[9]

4. Nutritional composition

The fruit is abundant in various minerals and vitamins which enhance its nutritional profile and make it a storehouse of disease fighting compounds. Variation in the values is observed based on size of fruit. The fruit is rich in ascorbic acid which contributes to the acidity of the fruit. β -carotene and anthocyanins are also found which are responsible for the unique color of the fruit. Spectrophotometric analysis has shown the presence of wide range of minerals like- potassium, copper, zinc, magnesium, iron, sulphur, and manganese. The berry contains around 608.9 mg % of vitamin-C and 257.1 μ g

of β -carotene. (Murugkar and Subbulakshmi, 2005) ^[2] The table (2) summarizes the various nutrients present in the fruit. The mineral content is discussed in another table, table (3). Calcium, zinc, magnesium, and iron were found in higher quantities in sohiong as compared to other plum and peach varieties. Rymbai *et al.* (2016) ^[16] have mentioned that sohiong contains higher amount of sulphur. The higher protein content may be because of the presence of high sulphur as sulphur is found majorly in the protein molecules. (Vivek, Mishra, and Pradhan, 2018) ^[18]

**Fig 3:** Graphical representation of nutritional profile of sohiong fruit (Rymbai *et al.* 2016) ^[16]**Table 3:** Mineral composition of Sohiong fruit

S.no.	Mineral	Amount (mg/100g)	Reference
1	Phosphorous	115	Rymbai <i>et al.</i> 2016 ^[16]
2	Sulphur	1362.5	Rymbai <i>et al.</i> 2016 ^[16]
3	Iron	9.6	Rymbai <i>et al.</i> 2016 ^[16]
4	Copper	1.56	Rymbai <i>et al.</i> 2016 ^[16]
5	Zinc	2.42	Rymbai <i>et al.</i> 2016 ^[16]
6	Manganese	7.70	Rymbai <i>et al.</i> 2016 ^[16]
7	Potassium	530	Rymbai <i>et al.</i> 2016 ^[16]

5. Polyphenolic compounds

Polyphenolic compounds are found in fruits and are mostly classified under flavonoids and phenolic acids. They are considered the most important organic compounds and are synthesized during plant development as well as a response to stress situations. They have an aromatic ring with one or more hydroxyl group attached to them. These compounds are responsible for the antioxidant activity of the fruits as they donate free electrons to the free radical. (Haminiuk *et al.*

2012)^[10] These organic compounds are responsible for imparting several properties such as anti-microbial, antiallergenic, antiviral, and anti-inflammatory. HPLC studies have confirmed the presence of tannic acid, purpurin, reserpine, methyl gallate, catechin, rutin and ascorbic acid. (Chaudhuri *et al.* 2015)^[6] These are helpful in providing health benefits to the people who consume these fruits. Other bioactive compounds that are found in the fruit are quinic acid, quercetin, scopoletin, rutin, palmitoleic acid, and naringenin. (Chaudhuri *et al.* 2015)^[6] The total phenol content ranges from 86.93 to 117.80 mg GAE/100 g depending upon the concentration of solvents used for extraction. (Kashyap *et al.* 2021)^[11] The IC₅₀ value of sohiong is 0.672 which is comparatively higher than strawberry. The fruit contains 46mg/100 g of ascorbic acid and around 0.215 mg/100 g of β -carotene. (Vivek, Mishra, and Pradhan, 2018)^[18] The anthocyanin content in the fruit is 358.86 mg/100g. (Rymbai *et al.* 2016)^[16]

Table 4: Phenolic compounds and pigments in sohiong fruit

S.no.	Parameter	Value	Reference
1	Total phenol	86.93 to 117.80 mg GAE/100 g	Kashyap <i>et al.</i> 2021 ^[11]
2	IC ₅₀	0.672	Vivek <i>et al.</i> , 2018 ^[18]
3	β -carotene	0.215 mg/100 g 2.76 mg/100g	Vivek <i>et al.</i> , 2018 ^[18] Rymbai <i>et al.</i> 2016 ^[16]
4	Anthocyanin	358.86 mg/100g	Rymbai <i>et al.</i> 2016 ^[16]

6. Utilization of fruit

The fruit is consumed as it is once fully ripened and is popular among the tribals and local people of the places it is cultivated. It is also processed to form products like jams, jellies, squashes and other Ready to Serve (RTS) products. Cherry wine produced from sohiong is also popular among locals. These products do not require refrigeration and have a shelf life of more than 6 months. The fruit pulp and juice are used to prepare wines and there is no need for the addition of any artificial color as the desirable purple color is already present in the fruit. Swer *et al.* (2018)^[17] extracted anthocyanins from the fruit with the help of cellulase enzyme.

HPLC data showed the presence of following anthocyanins in the fruit- petunidin-3-*O*-glucoside, cyanidin-3-*O*-glucoside, peonidin-3-*O*-glucoside and malvidin. (Swer *et al.* 2018)^[17] If made popular countrywide, the fruit has exceptional potential to be used in the food and pharma industries. Natural edible color can be extracted from sohiong and used in various other food products. (Rymbai *et al.* 2016)^[16] It can also be used to produce nondairy based probiotic drinks due to the presence of high number of phytochemicals. Fruit juice powder can be manufactured for making a product which will remain available all year round. Vivek *et al.* (2018)^[18] optimized spray drying conditions to produce sohiong fruit powder with maltodextrin as the coating material. The commencement of commercial cultivation of this fruit tree in other parts of the country may offer income opportunities and generate employment options for the tribal people.

7. Health benefits

Sohiong fruit is rich in various nutrients, vitamins, minerals, and phytochemical compounds. These compounds make it a potential fruit to fight several chronic and degenerative diseases. The high amount of anthocyanin pigments helps in the prevention of the diseases. The leaf of the plant also acts

as an astringent and is used as diuretics for the treatment of oedema. (Jajo *et al.* 2020)^[11] The antioxidant and restoration capability of the fruit has been studied in mice affected with liver fibrosis due to iron overdose. The fruit extracts when introduced in the mice showed excellent chelating properties with iron followed by its excretion from the mice's bodies. It also showed to assist in hepatic injury and fibrosis. Iron overload induced hepatotoxicity could be normalized by the fruit extract comparable to standard drugs. (Chaudhuri *et al.* 2015)^[6] The fruit also contains a decent amount of iron (3mg % on fresh weight basis) (Murugkar and Subbulakshmi, 2005)^[2]. Thus, it can be consumed by people who suffer from iron deficiencies like anaemia. *Prunus nepalensis* contains highest levels of crude fiber-47.2% (Murugkar and Subbulakshmi, 2005)^[2]. This may aid digestion and prevent constipation. The fruit is a good source of minerals and vitamins which help in the proper functioning of the body. The amount of vitamin C found in sohiong is 609mg % which is higher in comparison to the Indian gooseberry. It contains 257.1 μ g% of carotene (Murugkar and Subbulakshmi, 2005)^[2]. Consumption of phytochemical rich fruits reduces the risk of diseases like inflammation, cancer, cataracts, cardiovascular illness, neurodegenerative and macular degeneration. The high antioxidant activity of the fruit also prevents the free radical damage. The invitro studies have proven the role of antioxidants in the prevention of coronary heart diseases. The high number of macronutrients and micronutrients make the fruit a source of excellent health supplement. (Anand *et al.* 2018)^[3] Sohiong fruit has also been utilized for the extraction of copper nanoparticles which have potential anticancer properties in breast cancer studies. The synthesised copper nanoparticles of size 42.7nm showed inhibition of cell proliferation of MCF-7 cancer cells and showed no harmful side effects in the test human mammary epithelial cells (Biresaw and Taneja, 2022)^[5]

8. Value added/ processed products from Sohiong

Sohiong fruit is widely consumed by the local and tribal population of Khasi and Jaintia hills in both, raw and proceeded forms. Fresh fruits are consumed on maturity. Fruit juice, jams, RTS beverages and wines are popular amongst the locals and tribals. (Rymbai *et al.* 2016)^[16] Fruit bars or fruit rolls made from fruit puree have also been prepared from sohiong and banana mixed fruit purees. The candy like product has a chewy texture, sweet taste, and attractive color. (Das *et al.* 2021)^[8] This can be an excellent replacement for other unhealthy sugar loaded snacks in the market. The fruit has also been used for the extraction of pigments to use as a natural edible color in food, textile, and pharma industries. It is an excellent source for obtaining natural deep reddish-purple color. Solvent extraction using citric acid acidified ethanol. The fruit-solvent extract is freeze dried and then converted into powder form for further use. (Swer *et al.* 2018)^[17] Fresh fruit powders for use in the preparation of ready to drink powder juice can also be prepared from the fruit pulp. (Vivek *et al.* 2018)^[18] Dairy free probiotic juices for lactose intolerant people can also be made from sohiong fruit juice. *Lactobacillus plantarum* incorporated fruit juice can be served as a probiotic drink. (Vivek *et al.* 2019)^[19] Jams from a combination of 80-90% juice of passion fruit and sohiong can be prepared. (Dey *et al.* 2021)^[7] *Prunus nepalensis* has been utilized by the fruit preservation unit of department of agriculture of Government of Meghalaya for manufacturing

various jam, squash, and pickles. (Kharshandi *et al.* 2015)^[13]

9. Conclusion

Being an indigenous fruit, *Prunus nepalensis* is underutilized. The fruit is consumed by the tribals and locals in fresh form or made into juices, jams, or wines. The fruit is rich in macro and micronutrients. The bioactive compounds are also present in abundance in the fruit. It contains higher amount of anthocyanin pigments and therefore can be used to extract edible food color. Studies have been done to test the potential effects of the fruit extracts to cure degenerative chronic diseases like hepatotoxicity and cancer. Based on the above statements, it can be concluded that the increased cultivation and commercialization of the fruit can increase income and employment opportunities for the tribal people and its utilization can also be enhanced.

10. References

1. A review on *Prunus Nepalensis*: an indigenous fruit of Meghalaya September Project: natural product and pharmacology Honey Jajo Banshailang Nongsiej Greadency Mynthlu, Neisanuo Tsira; c2020.
2. Agrahar-Murugkar D, Subbulakshmi G. Nutritive values of wild edible fruits, berries, nuts, roots, and spices consumed by the Khasi tribes of India. *Ecology of food and nutrition.* 2005;44(3):207-223.
3. Anand SP, Deborah S, Velmurugan G. Evaluation of antioxidant activity of some wild edible fruits collected from Boda and Kolli hills. *The Journal of Phytopharmacology.* 2018;72:127-133.
4. Barua U, Das RP, Gogoi B, Baruah SR. Underutilized fruits of Assam for livelihood and nutritional security. *Agricultural Reviews.* 2019;40(3):175-184.
5. Biresaw SS, Taneja P. Copper nanoparticles green synthesis and characterization as anticancer potential in breast cancer cells (MCF7) derived from *Prunus nepalensis* phytochemicals. *Materials Today: Proceedings.* 2022;49:3501-3509.
6. Chaudhuri, Dipankar, Nikhil Baban Ghate, Sourav Panja, Abhishek Das, Nripendranath Mandal. Wild edible fruit of *Prunus nepalensis* Ser. (Steud), a potential source of antioxidants, ameliorates iron overload-induced hepatotoxicity and liver fibrosis in mice. *PloS one.* 2015;10(12):e0144280.
7. Commercial Crops Processing and Value Addition. The Institution of Engineers (India) Project: National Innovation in Climate Resilient Agriculture Dipankar Dey Debashish Sen Anup Das, 2021.
8. Das A, Bora BN, Chutia H, Lata Mahanta C. Processing of minerals and anthocyanins- rich mixed- fruit leather from banana (*Musa acuminata*) and sohiong (*Prunus nepalensis*). *Journal of Food Processing and Preservation.* 2021;45(9):e15718.
9. Dash KK, Shangpliang H, Bhagya Raj GVS, Chakraborty S, Sahu JK. Influence of microwave vacuum drying process parameters on phytochemical properties of sohiong (*Prunus nepalensis*) fruit. *Journal of Food Processing and Preservation.* 2021;45(3):e15290.
10. Haminiuk CW, Maciel GM, Plata- Oviedo MS, Peralta RM. Phenolic compounds in fruits—an overview. *International Journal of Food Science & Technology.* 2012;47(10):2023-2044.
11. Kashyap P, Riar CS, Jindal N. Optimization of ultrasound assisted extraction of polyphenols from Meghalayan cherry fruit (*Prunus nepalensis*) using response surface methodology (RSM) and artificial neural network (ANN) approach. *Journal of Food Measurement and Characterization.* 2021;15:119-133.
12. Kashyap P, Riar CS, Jindal N. Effect of extraction methods and simulated in vitro gastrointestinal digestion on phenolic compound profile, bio-accessibility, and antioxidant activity of Meghalayan cherry (*Prunus nepalensis*) pomace extracts. *LWT.* 2022;153:112570.
13. Kharshandi D, Lyngdoh D, Bokolia D. Minor fruits used by locals in two hill districts of Meghalaya, northeast India. *Asian Journal of Pharmaceutical & Biological Research (AJPBR),* 2015, 5(1).
14. Lata S, Yadav A, Kumar P, Yadav M. Biodiversity of underutilized fruits of the Himalayas. *Genetic Resources and Crop Evolution.* 2015;70(1):71-94.
15. Rymbai H, Deshmukh NA, Jha AK, Shimray W. Sohshur (*Pyrus pashia* Buch. & Ham.) Promising underutilized fruit crop of Himalaya tracts. *Biotech Article,* 2014.
16. Rymbai H, Patel RK, Deshmukh NA, Jha AK, Verma VK. Physical and biochemical content of indigenous underutilized Sohiong (*Prunus nepaulensis* Ser.) fruit in Meghalaya, India. *International Journal of Minor Fruits, Medicinal and Aromatic Plants.* 2016;(1):54-56.
17. Swer TL, Mukhim C, Bashir K, Chauhan K. Optimization of enzyme aided extraction of anthocyanins from *Prunus nepalensis* L., *LWT - Food Science and Technology,* 2018. doi: 10.1016/j.lwt.2018.01.043.
18. Vivek K, Mishra S, Pradhan RC. Physicochemical characterization and mass modelling of Sohiong (*Prunus nepalensis* L.) fruit. *Journal of Food Measurement and Characterization.* 2018;12:923-936.
19. Vivek K, Mishra S, Pradhan RC, Jayabalan R. Effect of probiotification with *Lactobacillus plantarum* MCC 2974 on quality of Sohiong juice. *Lwt.* 2019;108:55-60.
20. Lata LN, Burdon J, Reddel T. New tech, old exploitation: Gig economy, algorithmic control and migrant labour. *Sociology Compass.* 2023 Jan;17(1):e13028.