

Chapter 12

Wild edible plants: A precious gift of mother nature

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ABSTRACT:- Wild edible herbs are a priceless gift from nature, yet they are rarely used. The socio-cultural, spiritual, and health spheres of rural and tribal life have always placed a high value on wild edible plants. Wild edible plants are a sustainable food source that significantly improves dietary diversity and nutrient security.

The commercial cultivation of these edible wild medicinal herbs can be one of the most successful agricultural ventures for farmers.

Keywords: Wild edible plants, Nutrition, Medicinal, Cultivation, Conservation, Sustainable

1. INTRODUCTION

Plants are valuable resources for our survival, as they are important for the planet and for all living things. Without plants, we cannot imagine our lives as we depend on them for air, food, water, medicine, habitat, and our climate. Plants are the source of basic food for all organisms as they contain a wide variety of nutrients required to keep the human body in perfect working condition. Many plant species are unexplored, and were left out in the course of domestication; as a result, they remained wild or semi-wild. Wild edible plants are defined as those that are neither cultivated nor domesticated but are available from their

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natural habitat and are used as food sources¹. Many wild herbs, which are edible, have been with us for centuries, but they are neglected. They are so nutritious that they should not be ignored. Almost every part of the wild plant is used as edible, mostly fruits followed by leaves, seeds, shoots, flowers, tubers, and roots. They are mostly found in diverse habitats like forest areas, waste and cultivated lands, roadsides, backyards, ponds, or paddy fields. The forest's wild edible plants supply numerous critical nutrients that aid rural residents' physical and emotional well-being. It is estimated that 80% of forest dwellers depend on forests for 25-50% of their annual food requirements². They are inexpensive, easy to cook, and rich sources of macro and micronutrients^{3,4}. The maintenance of good health, vitality, and longevity by the rural tribals, may be due to consumption of these nutritious wild edibles. These nutritious wild edible plants can provide an alternative, inexpensive, and healthier source of food for an ever-increasing population.

Table 1: Description of some wild edible plants and their medicinal uses

| S.N. | Botanical name | Family | Common name | Local name | Available season | Medicinal uses |
|------|--|---------------|-------------------------------------|----------------|------------------|--|
| 1. | <i>Aerva lanata</i> , (L.) | Amaranthaceae | Mountain knotgrass | Lopung saag | Whole year | Renal calculi, snakebites, and dysuria ^{5,6} |
| 2. | <i>Alternanthera sessilis</i> , (L.) R.Br. | Amaranthaceae | Stalkless joyweed | Garundi saag | July-December | Hypertension, lactation ⁷ , chronic dysentery, malaria ⁸ , parkinsonism, eye disorder ⁵ |
| 3. | <i>Alternanthera philoxeroides</i> , (Mart.) Griseb. | Amaranthaceae | Alligator weed | Nadi saag | March-September | Antiviral, antidiarrhoea, anti-hypertensive, skin infection ⁹ . |
| 4. | <i>Alternanthera paronychioides</i> , A.St.-Hil. | Amaranthaceae | Smooth Chaff Flower, Smooth joyweed | Gudri saag | July-December | Antioxidant and antiglucotoxic activity ¹⁰ |
| 5. | <i>Boerhavia diffusa</i> , L. | Nyctaginaceae | Hogweed, Red spiderling, Pigweed | Rakt purnarnwa | April-September | Analgesic, antihepatotoxic, anti-inflammatory, diuretic, nephroprotective, antidiabetic, antioxidant, immunomodulatory, anticarcinogenic, cytotoxic, antiproliferative, antimicrobial, antiulcer ¹¹ |
| 6. | <i>Basella alba</i> , L. | Basellaceae | Malabar spinach | Poi saag | May-October | Antifungal, anaemia, ulcers, anti-inflammatory, Irregular periods, laxative, constipation, mouth ulcers ¹² |

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|-----|---|----------------|---|-------------------------------|------------------------|---|
| 7. | <i>Cassia tora</i> , (L.) | Fabaceae | Sickle senna, sickle pod, coffee pod | Chakodh saag | October to February | Antioxidant, Antimicrobial, Anti- inflammatory, Anti- proliferative, Antidiabetic, Hepatoprotective, Immunostimulatory, Antinociceptive, Spasmogenic ¹³ |
| 8. | <i>Centella asiatica</i> , (L.) Urb | Apiaceae | Indian pennywort | Brahmi / Gotu kola saag | Whole year | Asthma, psoriasis, leprosy, hairgrowth, constipation, memory booster ⁵ , liver tonic ^{5,6} |
| 9. | <i>Cleome monophylla</i> , (L.) | Capparaceae | Spindle pod | Charmani saag | February- August | Antiinflammatory, antidermatosis, anti rheumatic ¹⁴ |
| 10. | <i>Commelina benghalensis</i> , (L.) | Commelinaceae | Benghal dayflower, tropical spiderwort wandering Jew | Kena saag | June- September | Analgesic, wound healing, antimicrobial, antioxidant, diuretic, antidiarrheal, anthelmintic, sedative, hepatoprotective, fertility-inducing property, cytotoxic, anticancer, anti-viral ¹⁵ |
| 11. | <i>Dentella repens</i> (L.) J.R. Forst. | Rubiaceae | Creeping dentella | Kantha saag | September - March | Blood purifier, laxative ¹⁶ , poulticing sores ¹⁷ , |
| 12. | <i>Hygrophila spinose</i> , Tander | Acanthaceae | Marsh barbel | Kulekhara saag | July- March | Anti-inflammatory, analgesic, antipyretic, aphrodisiac, antineoplastic, hematopoietic, antibacterial, anti- helminthic, antidiabetic, antioxidant, hypoglycemic ¹⁸ |
| 13. | <i>Ipomoea aquatica</i> , Forssk. | Convolvulaceae | Water spinach | Kalmi saag | Whole year | Anti-oxidant, anti- inflammations, rheumatism ¹⁹ , blood purifier, gonorrhoea ⁷ |
| 14. | <i>Leucas aspera</i> , (Willd.) | Lamiaceae | Thumbai | Guma saag | Whole year | Snakebite, jaundice, antioxidant ¹⁹ , antigastic ⁸ , skin diseases ¹⁴ |
| 15. | <i>Marsilea quadrifolia</i> (L.) | Marsileaceae | Four leaf clover, European water clover, | Sunsunia saag | July- February | Anticonvulsant, antimicrobial, anti- stress, antibacterial, hypoglycaemic, antianxiety, antidiarrheal, insomnia, antiarthritic, antiasthma ²⁰ |
| 16. | <i>Medicago denticulate</i> , (Willd.) | Fabaceae | Toothed medick, burr medic | Khokhani saag | December- February | Analgesic, antiannnesic ²¹ |
| 17. | <i>Oxalis corniculata</i> , (L.) | Oxalidaceae | Yellow wood sorrel, creeping oxalis | Netho saag | February- October | Antifungal, antiulcer, anti- nociceptive, anti-cancer, antidiabetic, anxiolytic, anti-convulsant, anti- inflammatory, hepato- protective, hypolipidemic, antimicrobial, wound healing properties ²² |

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|-----|---------------------------------|-----------------|------------------------|--------------|----------------|--|
| 18. | <i>Portulaca oleracea</i> (L.) | Portulacaceae | Common purslane | Noni saag | May-October | Antidiabetic, antiarthritis, nephroprotective, anticancer, hepatoprotective, antioxidant, neuroprotective, antimicrobial, antiulcerogenic, anti-inflammatory ²³ |
| 19. | <i>Polygonum plebeium</i> R.Br. | Polygonaceae | Small knotweed | Chimati saag | April-November | Antioxidant, anti-inflammatory activity ²⁴ |
| 20. | <i>Spergula arvensis</i> | Caryophyllaceae | Corn spurry, stickwort | Kharika saag | Whole year | Antibacterial, laxative, antifungal, diuretic ²⁵ |

1. IMPORTANCE OF WILD EDIBLE PLANTS

Wild edible plants have several roles in our life; some of them are listed below:

2.1 WILD EDIBLE PLANTS AS A SOURCE OF NUTRITION

Numerous studies have explored the nutritional worth of wild edible plants and reported the health potential ingredients (protein, vitamins, minerals, organic acids, antioxidants, and dietary fiber) among these plants. Several studies have been found that highlight the importance of wild edible plants as food among indigenous people worldwide^{26,27}. Anywar *et al.* investigated 46 wild edible plant species that were used as food and medicine by the people of Nebbi district, Uganda²⁸. Turan *et al.* reported that the nitrogen, potassium, calcium, magnesium, and protein contents of wild edibles were all higher than those of cultivated species, such as spinach, pepper, lettuce, and cabbage. However, concentrations of iron, manganese, zinc, and copper were similar in both vegetable types²⁹. Horo and Topno studied and analyzed the nutritional value of 20 wild leafy plant species consumed by the Ho tribes of West Singhbhum district, Jharkhand. The result showed that these plants are rich in protein, energy, carbohydrates, potassium, magnesium, iron, calcium, phosphorus, vitamin A, and vitamin C as well as, can be used as a remedy for various diseases³⁰. Namrata *et al.* worked on 48 wild edible plant families in Uttarakhand Himalaya for their nutraceutical importance³¹. Vishwakarma and Dubey examined the nutritional status of indigenous wild edible herbs used in eastern Chhattisgarh, India. A total of seventy wild edible plant species were identified and recorded. Out of seventy plant species, 25 are chemically analyzed. Results indicate that these plants could be used for nutritional purposes due to their demonstrated good nutritional qualities and can help to overcome nutritional deficiency, especially in rural areas³².

2.2 UTILIZING WILD PLANTS FOR MEDICINE

Since the Vedic era, plant extracts have been used as source material for the treatment of various diseases. According to the Botanical Survey of India (BSI), India is home to more than 8,000 species of medicinal plants. Wild edible plants are used for the treatment of various ailments like heart diseases, diabetes, stomach disorders, anaemia, anti-inflammatory, immunity booster, skin infection and many more. In this aspect, 101 wild edible plants were recorded which are commonly used by Oroan community of Latehar district, Jharkhand as food and medicine³³. Above 400 ethno-medicinal plants are noted to be found in the state of Mizoram³⁴. Moreover, fifty-nine wild edible herbs were identified by Tareen et al. from the Harnai Balochistan district, Pakistan, that serve important purposes in the treatment of various ailments³⁵. 14 wild edible herbs consumed in South Africa have been reported to have ethnomedicinal values³⁶. Shin *et al.* (2018) also reported the consumption of 18 wild edible plants as medicinal food from Southern Shan State, Myanmar³⁷.

2.3 WILD EDIBLE PLANTS PROMOTE FOOD SECURITY

Wild plants represent a crucial section of the human diet. They are considered emergency food thereby reducing the vulnerability of local people to food insecurity, famine, or conflict. WEVs have played an important role among various ethnic groups since ancient times as vegetables. With the increase in global populations, food, and nutritional insecurity increased from 777 million in 2015 to 815 million in 2016³⁸. These statistics underline the fact that food scarcity is one of the most pressing problems faced by humans worldwide³⁹. Hunger, one of the most important concerns of this generation, can be supplemented, largely, by the inclusion of wild edible plants in the diet.

2.4 WILD EDIBLE PLANTS AS A SUSTAINABLE FOOD

The lifestyle that we lead today has put much stress on our health and the environment, so we need to focus on sustainable food. Sustainable food means that it has less of an impact on our planet and can be produced for a long time without creating large environmental concerns. Sustainable food aims to avoid damaging or wasting natural resources. It reduces the negative impact on the environment, climate change, and global warming. Due to high population growth, the demand for food increases, which leads industrial farming to use

harmful and toxic pesticides, chemicals, and machinery, and genetically modified organisms bring environmental change, which in turn, may leave future generations unable to meet the needs of their demands. The food system is responsible for roughly 21–40% of global greenhouse gas (GHG) emissions⁴⁰. According to Food and Agriculture Organization AQUASTAT data, in 2017 agriculture accounted for around 70% of freshwater use globally⁴⁰. Even though the world's existing food system can feed everyone, many people still go without food or do not have access to a healthy diet. On the other side, consuming more highly processed meals can be detrimental to one's health. Along with climate change, malnutrition (including excess and undernutrition) is regarded as a worldwide problem, highlighting the urgent need for a better and more sustainable food system. However, the century-old Study Area Tripura is a landlocked hilly state having a traditional knowledge system for the utilization of wild plants geographical area of 10,491 km is the second smallest and is depleting very quickly^{8,9}. Modern scientific state among the eight north-eastern states of India. Researchers are also trying to value these traditional foods. The state of Tripura accounts for 31% of the tribal population of the items to fill.

2.5 CULTIVATION OF WILD EDIBLE PLANT

Cultivation of wild edible is important to reduce our dependency over commercially cultivated vegetables. 12,000 plant species have been utilized as food over the course of history, but just 2,000 have been domesticated, and only approximately 150 are grown economically⁴¹. Cultivation means planting, improving, or harvesting of crops or plants. Farm and crop management is the act of taking care of or raising plants in order to encourage their growth. A number of wild edible plants are listed as endangered species, and the overharvesting of them in the wild puts them at greater threat of extinction. To ensure a stable supply of medicinal plants, efforts to cultivate them have been made. Before cultivation, soil is prepared accordingly. Potting soil mix consist of normal garden soil - 50%, sand/coco peat - 25%, and vermicompost - 25%. The prepared soil was putted in a pot of size 6 - 8 inches. In Asia, soil pH between 5.0 and 6.0 is recommended for cultivation. Different techniques of cultivation are hybridization, budding, layering, grafting, micropropagation, cropping system and crop rotation, seeding and sowing technique.

Cultivation of wild edible plant can decrease the amount to which wild populations are harvested, it will also help to preserve plant species from extinction and will promote socio-economic growth. The eradication of poverty, the assurance of food availability, the diversity of agriculture, and the reduction of malnutrition all benefit greatly from the use of wild edible plants. Encouragement of wild edible plant cultivation will help to generate better monetary returns as well as conserve these herbs in the wild and preserve traditional ethno-medicinal knowledge among local people. The businesses of medicines, cosmetics, drugs, and others receive their raw materials from these plants. Compared to other traditional and commercial crops, farmers get more money from the cultivation of medicinal and fragrant plants. Over \$5 billion is currently exchanged globally for medicinal plants, with India accounting for about \$3 billion.

3. CONSERVATION STATUS AND MANAGEMENT

It is clear that these wild edibles species are in decline due to human interventions in different ways, and needs in many cases a strict protection. The most often used conservation techniques include reintroduction, culture in botanical gardens, and in vitro propagation. Wild relatives need to be preserved because they have a higher genetic variety than crops and include features that can be bred into crops to increase their resilience and output. However, the potential resources of wild edible plants are threatened by anthropogenic causes (deforestation for firewood, charcoal, construction materials, agricultural land demand, overexploitation, etc.). However, due to changes in modern lifestyles, and close association with Western lifestyles, the traditional knowledge regarding the use of WEVs has vanished in several places that were recognized as one of the factors responsible for the negative impact on biodiversity conservation⁴². Hence, this study will be a baseline study and provide relevant information for policymakers and managers about local peoples' perceptions of the conservation and management of wild edible plants' sustainability and stability in food security.

There are usually two ways to assure the conservation of the species. One option is to use sporocarps from some of the sites and nurture the species *ex situ* in botanical gardens. This would allow for a potential reintroduction into the wild.

CONCLUSION

The outcome of the study is expected to give importance to these nutritious wild edibles, in order to prioritize them for their proper utilization, consumption, cultivation, and conservation. They play a significant role in eradicating poverty, ensuring the supply of food, diversifying agriculture, creating economic resources, and reducing malnutrition. These wild edibles can erase the gap and can favorably be used as a substitute for most of the commonly used vegetables. Rather they can be used as a good alternative source of food to alleviate hunger and malnutrition

Next to food and nutrition, the implementation of wild foods as coping strategies during scarcity is widespread, particularly in developing countries where food insecurity is more accurate. Therefore, it should be taken into consideration that the inclusion of edible wild and semi-cultivated plant resources could be advantageous to nutritionally marginal populations or to certain vulnerable groups within populations, especially in developing countries where poverty and climatic changes are devastating the rural people.

REFERENCES

1. Beluhan, S., & Ranogajee, A. (2010). Chemical composition and nonvolatile components of Croatian wild edible mushrooms, *Food Chemistry*, 124: 1076-1082.
2. Singh, N. (2011). Wild edible plants: a potential source of nutraceuticals. *International Journal of Pharma Sciences and Reasearch*, 2(2): 216-225.
3. Laxmi, B., & Vimala, V. (2000). Nutritive value of dehydrated green leafy vegetable powder. *Journal of Food Science and Technology*, 37(5): 465-471.
4. Grivetti, L. E., & Ogle, B. M. (2009). Value of traditional foods in meeting macro- and micronutrient needs: the wild plant connection. *Nutrition Research Reviews*, 13: 31-46.
5. Ediriweera, E. R. H. S. S. (2007). A Review on Medicinal uses of Weeds in Sri Lanka. *Tropical Agricultural Research and Extension*, 10: 11-16.
6. Jeeva, S., Kiruba, S., Mishra, B. P., Venugopal, N., Dhas, S. S. M., Regini, G. S., Kingston, C., Kavitha, A., Sukumaran, S., Raj, A. D. S., & Laloo, R. C. (2006). Weeds of Kanyakumari district

- and their value in rural life. *Indian Journal of Traditional Knowledge*, 5(4): 501-509.
7. Manju, C. N., Swapna, M. M., Kumar, P. R., Anoop, K. P., & Rajith, N. P. (2011). A Review on the medicinal and edible aspects of aquatic and wetland plants of India. *J of Med Plants Res*, 5(33): 7163-7176.
 8. Satapathy, K. B., Sahu, B. B., & Jena, G. S. (2012). Cropweeds diversity and their ethnomedicinal uses in the treatment of common ailments in Jajpur district of Odisha. *Int J Med Aroma Plants*, 2(1): 80-89.
 9. Carlos A. P., (1984). Pattern for common names of the medicinal weeds of the Argentine Republic. *Weed Magazine*, 12(4).
 10. *Alternanthera paronychioides*. *Tropicos.org. Missouri Botanical Garden* . Retrieved May 5, 2015
 11. Nayak, P., & Thirunavoukkrasu, M. (2016). A review of the plant *Boerhaavia diffusa*: its chemistry, pharmacology and therapeutical potential. *The Journal of Phytopharmacology*, 5(2): 83-92.
 12. Shruthi, S. D., Roshan, A., & Kumar N. H. N. (2012). A Review on Medicinal importance of *Basella alba* L. *Int J Pharma Sci and Drugs Res*. 4(2):110-114
 13. Bhandirge, K.S., Patel, V., Patidar, A., Pasi, A., & Sharma, V. (2016). An overview on phytochemical and pharmacological profile of *Cassia tora* Linn. *International Journal of Herbal Medicine*, 4(6):50-55.
 14. Khare, C. P. (2007). *Encyclopedia of Indian Medicinal Plants*. Springer, New York. 1-739.
 15. Roy, P., Shetu, J. H., Khan, T., Rashed, S. S. B., & Dash, P. R. (2018). A Comprehensive review on *Commelina benghalensis* L. (Commelinaceae). *Orni et al., IJP*, 5(10):637-645.
 16. Singh, P. and Ali, J. S. (2012). Antidiabetic herbal medicines of Eastern U.P. *Indian J. L. Sci*, 1(2):105-107.
 17. Swapna M. M., Prakashkumar R., Anoop K. P., Manju C. N., & Rajith N. P. (2011). A review on the medicinal and edible aspects of aquatic and wetland plants of India. *Journal of Medicinal Plants Research*, 5(33): 7163-7176.

18. Ganguly, D., Mitra, S., Chatterjee, S., & Choudhury, A. (2021). A Brief review on health benefits and medicinal uses of *Hygrophila spinose* (T). *Journal of Applied Pharmacognosy and Phytochemistry*, 1(1): 11 - 14.
19. Sahu, R. K., Kar, M., & Rasmirani, R. (2013). DPPH free radical scavenging activity of some leafy vegetables used by tribals of Odisha. *India J. of Med Plants Studies*, 1(4): 21-27
20. Balakrishnan, S., & Subramanian, M. (2016). A Review on *Marsilea quadrifolia* L. - A Medicinally Important Plant. *Journal of comprehensive pharmacy*, Volume 3(2): 38-44.
21. Ahmad, S., Khan, S., Zeb, A., Ali, W., Ahmed, B., Khan, A. A., Ali, W., & Zaman, N. (2021). Evaluation of Analgesic, Antiamnesic and Antidiarrheal Potentials of *Medicago denticulata* extract using animal mode. *Saudi Journal of Biological Sciences*, 28: 6352-6358.
22. Anika, A. K., Shorna, F., Khan, S. S., Singh, T., & Dash, P. R. (2020). Therapeutic potentials of *Oxalis corniculata* Linn. As a Medicinal plant: A Review. *International journal of pharmacognosy*, 7(4): 87-95.
23. Chugh, V., Mishra, V., Dwivedi, S. V., & Sharma, K. D. (2019). Purslane (*Portulaca oleracea* L.): An underutilized wonder plant with potential pharmacological value. *The Pharma Innovation Journal*, 8(6): 236-246.
24. Ahsan, H., Mustaq, M. N., Anjum I., Fiaz, M., Cheema, A. R., Haider, S. I., & Tekulu, G. H. (2019). Preliminary research regarding chemical composition and anti-inflammatory effects of *Polygonum plebeium* R.Br. *FARMACIA*, 69(5): 954-959.
25. Ijaz, A., Najeeb, U., Saima, S., Rehman, A., Ullah, H., & Farhan. (NA) Antibacterial and Antifungal study of *Spergula arvensis*. *Int J S ci Innov and Discover*, 3(3): 348-352
26. Dénes, A., Papp, N., Babai, D., Czúcz, B., & Molnár, Z. (2012). Wild plants used for food by Hungarian ethnic groups living in the Carpathian Basin. *Acta societatis botanicorum Poloniae*, 81(4).
27. Sujarwo, W., Arinasa, I. B. K., Salomone, F., Caneva, G., & Fattorini, S. (2014). Cultural erosion of Balinese indigenous

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- knowledge of food and nutraceutical plants. *Economic Botany*, 68(4): 426-437.
28. Anywar, G., Oryem-Origa, H., & Mugisha, M. K. (2014). Wild plants used as Nutraceuticals from Nebbi District, Uganda. *European Journal of medicinal plants*, 4(6), 641-660.
29. Turan, M., Kordali, S., Zengin, H., Dursun, A., & Sezen, Y. (2003). Macro and micro mineral content of some wild edible leaves consumed in Eastern Anatolia. *Acta Agriculturae Scandinavica. Section B, Plant and Soil Science*, 53: 129-137.
30. Horo, S., & Topno, S. (2015). Study and analysis of nutritional value of some wild and semi-wild edible plants consumed by "HO" tribes of West Singhbhum district, Jharkhand, India. *International Journal of Herbal Medicine*, 3(5): 25-32.
31. Namrata, Kumar, L., Ghosh, D., Dwivedi, S. C., & Singh, B. 2011. Wild edible plants of Uttarakhand Himalaya: A potential Nutraceutical source. *Research Journal of Medicinal plants*. 5 (6): 670-684.
32. Kanchan, Lata Vishwakarma and Veenapani, Dubey. (2011). Nutritional analysis of indigenous wild edible herbs used in eastern Chhattisgarh, India. *Emir. J. Food Agric*, 23(6): 554-560.
33. Marandi, R. R., & Britto, S. J. (2014). Ethnomedicinal plants used by Oraon tribals of Latehar district of Jharkhand, India. *Asian Journal of Pharmaceutical Research*, 4(3): 126-133.
34. Lalramnghinglova, H. (2003). *Ethno-medicinal plants of Mizoram*. Bishen Singh Mahendra Pal Singh publications.
35. Tareen, N. M., Saeed-ur-Rehman, M. A., Shinwari, Z. K., & Bibi, T. A. H. I. R. A. (2016). Ethnomedicinal utilization of wild edible vegetables in district Harnai of Balochistan Province-Pakistan. *Pakistan Journal of Botany*, 48(3): 1159- 1171.
36. Mokganya, M. G., & Tshisikhawe, M. P. (2019). Medicinal uses of selected wild edible vegetables consumed by Vhavenda of the Vhembe District Municipality, South Africa. *South African Journal of Botany*. 122: 184-188.
37. Shin, T., Fujikawa, K., Moe, A. Z., & Uchiyama, H. (2018). Traditional knowledge of wild edible plants with special emphasis on medicinal uses in Southern Shan State, Myanmar. *Journal of ethnobiology and ethnomedicine*. 14(1): 48.

38. Jman, & Redzic S. (2006). Wild edible plants and their traditional use in the human nutrition in Bosnia Herzegovina. *Ecology of Food and Nutrition*. 45(3): 189-232.
39. Francesco, N. T., Cynthia, R., Giulia, C., Kevin, K., Johannes, G., Pan, X., Griffiths, O., Nathan, W., Sally, Y. Q., & Julio, D. B. (2021). Greenhouse gas emissions from food systems: building the evidence base. *Environmental Research Letters*, 16(6).
40. Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., & Wood, A. (2019). Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems, *Lancet*, 393(10170): 447-492. [https://doi.org/10.1016/S0140-6736\(18\)31788-4](https://doi.org/10.1016/S0140-6736(18)31788-4).
41. Williamson, G., Dupont, M. S., Heaney, R. K., Roger, G. & Rhodes, M. J. (1997). Induction of glutathione S transferase activity in hepG2 cells by extract of fruits and vegetables. *Food chemistry*, 2: 157-160.
42. Shrestha, P. M. & Dhillon, S. S. (2006). Diversity and traditional knowledge concerning wild food species in a locally managed forest in Nepal. *Agroforestry Systems*, 66(1): 55-63.