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Analysis of a Wild Leafy Vegetable (*Premna latifolia* Roxb.) Samples for Essential Trace Elements using ICP - MS Technique

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Abstract: ***Leafy vegetables are rich sources of nutrients including mineral ions, which are essential for proper functioning of body organs. Premna is one such wild leafy vegetable, leaves of Premna have been collected from three different villages, these samples are analyzed for elemental levels by using Inductively Coupled Plasma - Mass Spectroscopy (ICP - MS), to measure the values of 6 essential elements in each sample. Essential trace elements Al, Mn, Fe, Co, Cu, and Zn have been measured for their levels. The concentration of each element of this plant is calculated and reported.***

Keywords: ICP - MS, Trace elements, Wild plants, Leafy vegetables, Nutrition value

1. Introduction

Wild and cultivated leafy vegetables are rich sources of essential nutrients, offering a lot of health benefits, some of them are having harmful elements also at high levels (Murthy and Yadav, 2024). Wild varieties, found in natural ecosystems, include species like *Portulaca oleracea*, *Polygonum plebijum*, *Trianthemamonogyna*, etc. (Rekha, 2018). These plants are characterized by their flexibility and adaptability, thriving in diverse environments. On the other hand, cultivated leafy vegetables, such as spinach (*Spinacia oleracea*), kale (*Brassica oleracea* var. acephala), *Trigonella foenum - graecum*, Swiss chard (*Beta vulgaris* var. cicla) etc. are mainly grown for culinary purposes (Kumar, 2020). They are all packed with vitamins, minerals, and antioxidants, contributing to overall health. They are particularly rich in vitamin K, vitamin A, folate, Iron, and Calcium; promoting bone health, immune function, and vision. This present study is an attempt to estimate the elemental values in a wild leafy vegetable.

2. Materials and Methods

2.1 Study area

Study area situated in the Kaviti Revenue Mandal of Srikakulam district, Andhra Pradesh, India, where this plant is widely used as leafy vegetable. Three villages (Kusumapuram, Varaka, and Borivanka) have been selectedand the samples are collected from these villages and analyzed for elemental values. The details of the study area are provided in Fig.1.

2.2 Morphology:

Scientific name: *Premna latifolia* Roxb.; Family: Verbanaceae
Common name (s): Nellikura (Telugu), Jhatela, Basota (Hindi), Jaya, Agimantha, Sriparna (Sanskrit).

*Premna*plants are shrubs or small trees nearly 10 - 15 feet long with a wide roof, trunk has dark grayish bark, slightly polar, black when dried; young parts pubescent and young trunks are spinous. Leaves are simple, opposite, lanceolate - ovate, elliptic - ovate to rhomboidal, entire and ciliate, apex is acute. Leaves are green in colour unpleasant smelling. Lateral veins 4 - 8 on either side of lamina, they are prominent beneath the lamina. Inflorescence is either apical or axillary. It is panicle or compact cyme. Flowers are bisexual, many, odorless, creamy white, yellowish green (Kumar et al, 2017).

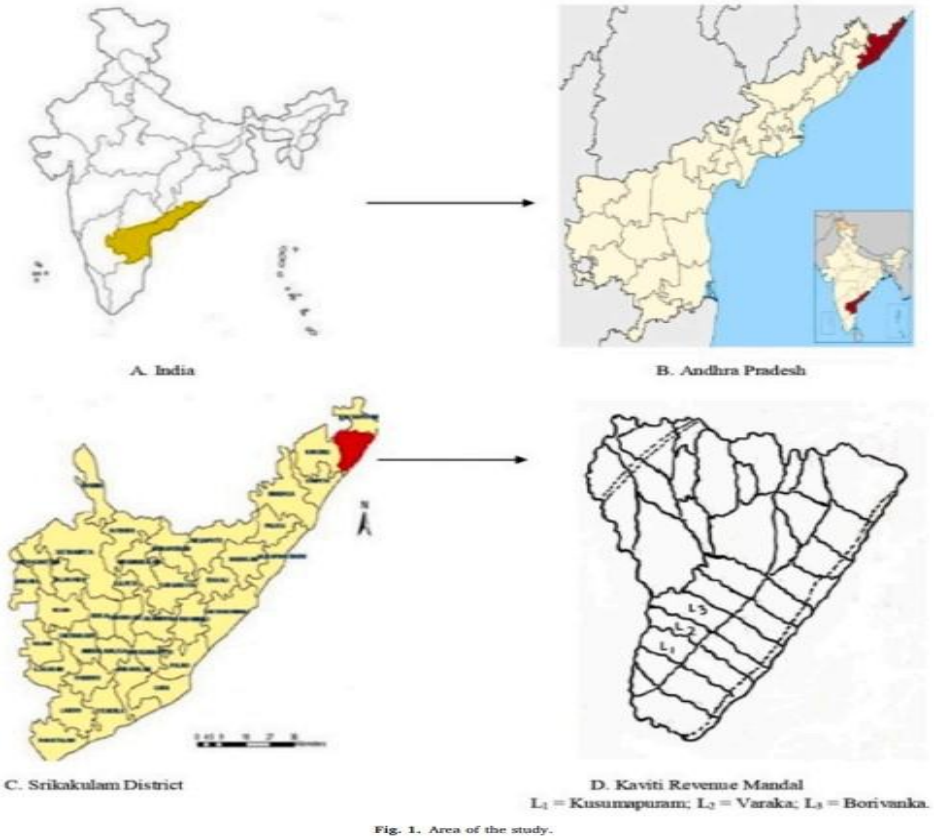

Fig. 1. Area of the study.

Figure 1: Study area

2.3 Sample Collection

Samples have been collected from the fields directly; kept in zip locked bags. Shifted to labi. e. CSBoB (Center for Studies on Bay of Bengal), Andhra University, Visakhapatnam. Samples have been washed twice with distilled water, shade dried and then acid digestion process was carried out to digest all organic matter in the samples.

2.4 Methodology and Wet digestion:

ICP - MS technique is followed to estimate the elemental levels in the sample. There are advantages to ICP - MS method for the determination of cations in solution, as high temperatures (above 6000 ^{0}C), complexes and or residuals can be converted into basic form i.e. ionomic form, so we can easily estimate element levels accurately. Fast and accurate wet digestion method is followed for the digestion of plant samples and subsequent analysis of elemental (Al, Mn, Fe, Co, Cu, and Zn) levels. Initially0.5 g leaf sample is taken into Teflon Beakers.8 ml of $HN0_3$ added to this and left overnight. The solution was heated on a hot plate at 120 - 125 ^{0}C for one hour, with 1 - 2 additions of 4ml H_20_2 (33%) until solution is clear/colorless indicates complete digestion of material (Pequerul et al., 1993). The residue was brought to a dry place on low heat (80 ^{0}C), shaken well, after cool to room temperature diluted to known volume (50ml) with 2D water, and stored in High Density Poly Ethylene (HDPE) bottles of 100 ml volume for further use at room temperature.

3. Results and Discussion

Many elements are essential for proper functioning biological metabolisms, the results of the study reveal that the levels of essential trace elements (Aluminum, Manganese, Iron, Cobalt, Copper, Zinc) in different locations (Kusumapuram, Varaka, Borivanka) is presented in Table and Fig.2.

Table: Essential trace element values (ppm) in *Premna latifolia* Roxb. from three villages

Location	Al	Mn	Fe	Co	Cu	Zn
Kusumapuram	11.67	8.5	15.73	0.03	0.47	8.91
Varaka	7.64	15.67	21.02	0.06	0.4	6.59
Borivanka	17.22	3.3	23.63	0.04	0.32	9.81

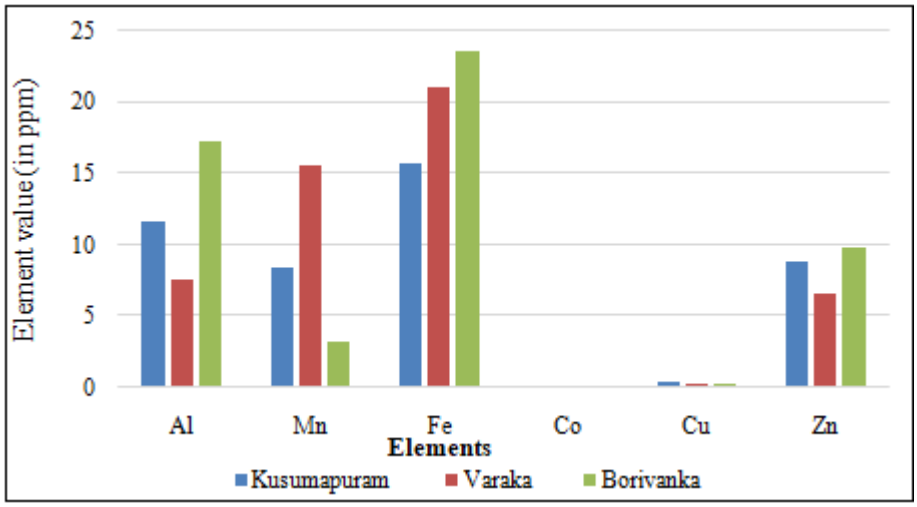

Figure 2: Essential trace element values (ppm) in *Premna latifolia* Roxb. from three villages

- **Aluminium:** The high level of Al is observed in Borivanka (17.22), followed by Kusumapuram (11.67) and Varaka (7.64). There is an increasing trend in Al levels from Varaka, Kusumapuram to Borivanka.
- **Manganese:** The high level of Mn is found in Varaka (15.67), followed by Kusumapuram (8.5) and Borivanka (3.3). There is a decreasing trend in Mn levels from Varaka, Kusumapuram to Borivanka.
- **Iron:** The high Fe levels are recorded in Borivanka (23.63), followed by Varaka (21.02) and Kusumapuram (15.73). There is an increasing trend in Fe levels from Kusumapuram, Varaka to Borivanka.
- **Cobalt:** The levels are very low in all locations, of course it requires in minute values. Varaka (0.06) having the high values, followed by Borivanka (0.04) and Kusumapuram (0.03). There is a minimal fluctuation in cobalt levels among the three locations.
- **Copper:** The high Cu levels are observed in Kusumapuram (0.47), followed by Varaka (0.4) and Borivanka (0.32). There is an increasing trend in Cu levels from Borivanka, Varaka to Kusumapuram.
- **Zinc:** the highest Zn levels are found in Borivanka (9.81), followed by Kusumapuram (8.91) and Varaka (6.59). There is an increasing trend in Zn levels from Varaka, Kusumapuram to Borivanka.

In summary, there are varying trends in the levels of essential trace elements across the three locations, and these trends may be influenced by factors such as geological composition, environmental conditions, and human activities in each area.

The aforementioned elements play important roles in various metabolic processes as follows:

- **Aluminium:** It may play a role in some enzymatic processes, particularly in certain plants.
- **Manganese:** Essential for the activation of enzymes involved in bone formation, blood clotting, and reducing oxidative stress in the body.
- **Iron:** Crucial for oxygen transport in hemoglobin, electron transport in cellular respiration, and the synthesis of certain enzymes and proteins.
- **Cobalt:** An essential component of vitamin B12 (Cobalamin), which is crucial for DNA synthesis, red blood cell formation, and neurological function.
- **Copper:** Essential for the formation of hemoglobin, collagen, and various enzymes involved in antioxidant defense and cellular energy production.
- **Zinc:** Plays a critical role in the functioning of enzymes involved in DNA synthesis, immune function, wound healing, and the sense of taste and smell.

4. Conclusion

Previous studies conclude that *Premna latifolia* Roxb., extracts contain bioactive compounds, including flavonoids, steroids, terpenoids, tannins, glycosides, alkaloids, reducing sugars, Phenols, Quinones, Lignin, and fixed oils. Methanolic extracts from leaves and bark exhibit the highest phenolic and flavonoid content, indicating strong antioxidant and free radical scavenging activity (Pushpa, 2019), and the present study reveal that it contains essential trace elements.

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