Element Profile of Some Plants used in Traditional Medicine

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Element Profile of Some Plants used in Traditional Medicine

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ABSTRACT

Three medicinal plants viz. *Syzygium cumini* L., *Boerhavia erecta* L. and *Gymnema sylvestre* Retz. have been selected to study the mineral profile. These plants were subjected to know 14 different macro and micro elements. Current investigation highlights supportive role of mineral elements for medicinal potential of studied plants. It can be concluded from the results that *S. cumini, B. erecta, G. sylvestre* having powerful Fe, Zn, Mo, uptake potential which is supportive to their various disease resistant properties.

Key words: *Syzygium cumini, Boerhavia erecta, Gymnema sylvestre*

Introduction

India is one of the world's mega biodiversity center having more than 45000 different plant species. However, only 7000-7500 species are used for their medicinal values by traditional communities [1]. From back centuries human race rapidly tried to gather knowledge of ancient ethnic medicines and their sources. From ancient time the world population depends mainly on plants and plant extracts for health care. From India, drugs of herbal origin have been documented mostly in *Unani* and *Ayurveda* since ancient times. The herbal products today represent safety in contrast to the synthetics that are regarded as unsafe to human and environment. The drugs are derived either from the whole plant or from different organs, like leaves, stem, bark, root, flower, seed, etc. Some drugs are prepared from excretory plant product such as gum, resins and latex.

Here is an attempt has been made to know which are acting element for medicinal properties with the help of medicinal plants viz. *Syzygium cumini* L., *Boerhavia erecta* L. and *Gymnema sylvestre* Retz. *Syzygium cumini* Linn from family Myrtaceae, is a medicinal plant native to India. It has medicinal properties like antibacterial activity, antioxidant properties, vibriocidal properties, antiallergic properties, antinociceptive properties, anti-inflammatory properties and some chemoprotective properties [2-7].

Boerhavia erecta is from family Nyctaginaceae, it is weedy herb and is commonly available in almost all places. It is used as a traditional medicinal plant in Africa. It has been found to possess diuretic action Singh *et al*. [8], anti-inflammatory, antifibrinolytic, anticonvulsant and hepatoprotective activities [9-12].

Gymnema sylvestre is a woody, climbing plant, native to India. *Gymnema sylvestre* is Asclepiadaceae family member used as stomachic, diuretic, refrigerant, astringent, and tonic [13]. Importance of this plant as antidiabetic purpose have been reported by Prakash *et al.* [14] and Shanmugasundaram *et al.* [15]. *Gymnema* amplifies the activity of enzymes responsible for glucose uptake and utilization [16] and inhibits peripheral utilization of glucose by somatotrophin and corticotrophin [17] and inhibit epinephrine-induced hyperglycemia [18].

Materials and Methods

Various inorganic constituents like Na^{+}, K^{+}, P^{5+}, Mg^{2+}, Fe^{3+}, Mn^{2+}, Ca^{2+}, Cu^{2+}, Zn^{2+} were estimated from the *Syzygium cumini* L. (seed), *Boerhavia erecta* L.(leaves) and *Gymnema sylvestre* Retz. (leaves). Oven dried plant material was powdered and 0.5 g of sample was acid digested following the standard method of Toth *et al.* [19]. Total nitrogen content in plant material was estimated following the method given by Hawk *et al.* [20]. The nitrate contents were determined using rapid colorimetric method by nitration of salicylic acid Cataldo *et al.* [21].

Table 1: Mineral contents in *Syzygium cumini* L., Boerhavia erecta L. and Gymnema sylvestre Retz

Sr. No.	Parameters	Mineral constituents mg/100g			Mineral constituents % (g/100g)		
		***Syzygium cumini* L.**	***Boerhavia erecta* L.**	***Gymnema sylvestre* Retz.**	***Syzygium cumini* L.**	***Boerhavia erecta* L.**	***Gymnema sylvestre* Retz.**
1	Nitrogen	1680	1060	1620	1.68	1.06	1.62
2	Nitrate N	50	50	56	0.05	0.05	0.056
3	Phosphrous	84	102	102	0.084	0.102	0.102
4	Potassium	700	950	1050	0.7	0.95	1.05
5	Calcium	1300	1200	800	1.3	1.2	0.8
6	Magnesium	640	510	410	0.64	0.51	0.41
7	Sulphur	120	85	85	0.12	0.085	0.085
8	Sodium	200	800	250	0.2	0.8	0.25
9	Zinc	444.4	661	994.2	0.4444	0.661	0.9942
10	Ferrous	42976	38668	38908	42.976	38.668	38.908
11	Copper	438.4	381.2	498.4	0.4384	0.3812	0.4984
12	Mangenese	3286.2	4528	3888	3.2862	4.528	3.888
13	Molybdenum	7.4	8.2	8.2	0.0074	0.0082	0.0082
14	Boron	251	352.8	385	0.251	0.3528	0.385

Result and Discussion

All living organisms require a continuous supply of various elements from outside to complete their life cycle. This supply is called as nutrition. Green plants have comparatively simple nutrient requirements for completion of more or less all metabolic processes as macronutrients (N, P, K, Ca, Mg, S, and Na) and micronutrients (Fe, Mn, Cu, Zn, Mo, B and Cl) requirement. The mineral nutrition is an important aspect of plant growth that governs the productivity of all plants. Here is an attempt have been made to know exact requirement of minerals for proper growth of medicinal plants (Table 1).

Each and every element has their specific role in plant growth and metabolisms. Sodium stimulates growth through enhanced cell expansion and it is essential in maintaining membrane integrity [22]. Potassium also plays a significant role in processes such as photosynthesis, translocation of proteins and carbohydrates, stability of ribosomes, protein synthesis, nitrogen turnover, carbohydrate metabolism, glycolysis, phosphorylation and adenine biosynthesis in plants [23-25]. Calcium is also a non- toxic mineral nutrient, even in high concentration and is very effective in detoxifying high concentrations of other mineral elements in plants. Clarkson and Hanson [26] reported major role of calcium in plants is to bind with proteins, nucleic acids and lipids to affect cell adhesion, membrane chromatin organization and enzyme conformation. Magnesium is having contribution to the center of the chlorophyll molecule. It also act as a cofactor of several enzymatic reactions involved in organic acid synthesis. Mg act as catalyst for many enzymes such as RuBP-carboxylase, ATPase, Fructose 1,6-diphosphatase and glutamate synthetase [27]. Manganese is associated with photosynthesis, respiration, oxidation of carbohydrates and IAA and activation of enzymes of nitrogen metabolism. Manganese activates the enzymes like IAA-oxidase, decarboxylases, and dehydrogenases of TCA cycle Mengel and Kirkby [27].

According to Machold and Stephan [28] iron has role in the synthesis of common precursors of chlorophyll. Zinc has role in various metabolic processes as carbohydrate metabolism, nitrogen metabolism, protein synthesis, auxin synthesis; particularly IAA synthesis and it act as catalist for many enzymes. It participates in synthesis of indole acetic acid from its precursor, tryphtophan [29-30]. Copper plays a vital role in reproductive growth as well as another trace element whose requirement in redox reactions of photosynthesis is well known [31]. Among all the mineral nutrients nitrogen is very essential for synthesis of many organic compounds. According to Gallacher and Sprent [32] total nitrogen content in plant reflects total plant growth. Higher nitrate content indicates increase in toxicity in plant species. Higher phosphorus content signifies the high metabolic activities associated within this plant species. The primary function of the boron element is to provide structural integrity to the cell wall in plants. The optimum boron content of the leaves for most crops is 20-100 ppm [33]. Improvement in plant molybdenum levels results in a decrease of disease [34].

Syzygium cumini L. (seed), *Boerhavia erecta* L.(leaves) and *Gymnema sylvestre* Retz. (leaves) contain 0.2, 0.8 and 0.25 % sodium (dry wt.) respectively. The range of sodium in glycophytes as given by Gauch [35] is 0.1 to 1.4% dry wt. It is evident from results (Table 1) that all studied species have proper range of uptake potential for sodium. Plants require 1% potassium for their optimal growth [36]. In present study, results indicates that *S. cumini* L. (seed), *B. erecta* L.(leaves) and *G. sylvestre* Retz. (leaves) contain 0.7, 0.95 and 1.05 % potassium (dry wt.) respectively. For proper growth *S. cumini* L. and *B. erecta* L. requires less amount of potassium than that of critical level mentioned by Epstein [36]. The level of calcium in studied species is 1.3, 1.2 and 0.8 % respectively. Which is also very less than that of normal requirement of plant.

Magnesium level in *S. cumini* L. (seed), *B. erecta* L. (leaves) and *G. sylvestre* Retz. (leaves), 0.64, 0.51 and 0.41 % (dry wt.) of respectively. But it is also less than that of optimum level 2% mentioned by Epstein [36]. Similar result recorded in *Portulaca oleracea* leaves, 0.3 % (dry wt.) magnesium by Karadge [37] and that in *Cassia* species, 0.28 to 0.37 % (dry wt.) magnesium by Patil [38]. In studied species, leaves of *B. erecta* L. have the highest manganese uptake potential (i.e. up to 4.5%) than other species. Leaves of *G. sylvestre* and seeds of *S. cumini* contain 3.8% and 3.2 % (dry wt.) of manganese respectively. Similar kind of result recorded by Gole *et al.* [39] in leaves of *Commelina bengalensis, Cyanotis cerifolia, Zebrina pendula* contain 1.08, 1.75 and 2.14 % (dry wt.) of manganese respectively. In case of copper uptake, potential optimum level required is 6 ppm dry wt [36]. But studied species show higher level of copper uptake potential. The plant species *S. cumini* L., *B. erecta* L. and *G. sylvestre* Retz. contain 21.92, 19.06 and 24.92 ppm of copper (dry wt.) of respectively.

Which is same that of in some commelinaceae members recorded by Gole *et al.* [39] i.e. *Cyanotis cerifolia* 29.03ppm and *Zebrina pendula* 20.43 ppm dry wt. copper. Stout [40] reported 100 ppm is adequate value of iron for optimal growth of plants. It is evidence form result that studied medicinal plants have higher ferrous uptake, it may supports their medicinal properties studied early. Levels of zinc in studied plant is higher than its critical toxicity levels (Table 1). Higher level, of zinc in all studied species supports their tolerance capacity for any kind of environmental stress. It is evident from the result that the total nitrogen content in seeds of *S. cumini* L., (1.68%) is higher than that in leaves of *B. erecta* L. (1.06%) and in *G. sylvestre* Retz. (1.62%). But nitrate level is observed higher in *G. sylvestre* Retz. than other species.

The optimum concentration of phosphorus for normal growth of plant is 0.2% dry wt. [40]. But here studied plants show (table 1) low level of phosphorus requirement than optimum level mentioned by Stout [40]. In present study, sulphur content in *S. cumini* L. (seed), *B. erecta* L. (leaves) and *G. sylvestre* Retz. (leaves), are respectively 0.12, 0.085 and 0.085 g100g-1 of dry wt. which is very high than that of its requirement. Gole *et al.* [39] recorded similar result of sulphur requirement in commelinaceae members (0.14- 0.17 %) and also same level of molybdenum content in leaves of *Commelina bengalensis* (0.40 ppm). The molybdenum content in leaves of *B. erecta* L. and *G. sylvestre* is exactly same (0.41 ppm). While in seed of *S. cumini* L. (0.37 ppm) are depicted in Table 1. This is higher than that of optimal requirement. Plants contain Boron both in a water-soluble and insoluble form. But it required in very small quantities. Although Boron requirements vary among crops, the optimum boron content of the leaves for most crops is 20-100 ppm [33]. It is evidence from result that boron content in leaves of *B. erecta* L. and *G. sylvestre* is 17.64 ppm and 19.25 ppm respectively. While that in seed of *S. cumini* L. (12.55 ppm) are depicted in Table 1. This is less than that of optimal requirement but plant does not show any kind of deficiency syndrome.

Conclusion

It can be concluded from result that all studied species viz. *S. cumini* L., *B. erecta* L. and *G. sylvestre* Retz. having powerful ferrous, zinc and molybdenum uptake potential. It indicates that these species may have potential to tolerate any kind of environmental stress and also supports their high medicinal potential properties against many pathogens. The result may form direct evidence to conclude that higher molybdenum levels in plant results in a decrease of disease.

Reference

1. PP Joy, J Thomas, S Mathew, BP Skaria. Medicinal Plants. *Kerala Agricultural University, Aromatic and Medicinal Plants Research Station*, 1998.
2. LL Zhang, YM Lin. *African Journal of Biotechnology*, 2009, 8, 2301-2309.
3. L Jacob, AS Titus, *Academic Review*, 2009, l, 11-18.
4. N Paul, AA Akhand, SU Babu, N Islam, N Ahsan. *J. Adv. Lab. Res. Bio.*, 2011, 2.
5. FA Brito, LA Lima, MFS Ramos, MJ Nakamura, SC Cavalher-Machado, AC Siani, MGMO Henriques and ALF Sampaio. *J Med Biol Res* 2007, 40, 105-115.
6. N Archana, M Ramasamy, Raj C David. *Int J Pharm Sci*, 2012, 4, 108-110.
7. A Kumar, N Padmanabhan, MRV Krishnan. *Pakistan Journal of Nutrition*, 2007, 6, 698-700.
8. RP Singh, KP Shokala, BL Pandey, RG Singh, UR Singh. *Journal of Indian Medicinal Research*,1992, 11, 29–36.
9. TN Bhalla, MB Gupta, KP Bhavgava. *Journal of Indian Medicinal Research*, 1971, 6, 11–15.
10. GK Jain, NM Khanna. *Indian Journal of Chemistry*, 1989, 28, 163–166.
11. V Mudgal. 1975, 28, 62–68.
12. BK Chandan, AK Sharma, KK Anand. 1991, 31, 299–307.
13. LD Kapoor. Handbook of Ayurvedic Medicinal Plants. Boca Raton, FL:CRC Press, Inc; 1990, 200-201.
14. AO Prakash, S Mather, R Mather. *J Ethnopharmacol* 1986, 18, 143-146.
15. ER Shanmugasundaram, KL Gopinath, KR Shanmugasundaram, VM Rojendran. *J Ethnopharmacol* 1990, 30, 265-279.
16. KR Shanmugasundaram, C Panneerselvam, P Samudram, ER Shanmugasundaram. *J Ethnopharmacol*, 1983, 7, 205-234.
17. SS Gupta, MC Variyar. *Indian J Med Res* 1964, 52, 200-207.
18. SS Gupta. *Indian J Med Sci*, 1961, 15, 883-887.

19. SJ Toth, AL Prince, A Wallace, DS Mikkelsen. *Soil Sci*. 1948, 66, 456-466.
20. PB Hawk, BL Oser. Summerson WH. Practical physiological chemistry (Publ.). The Blockiston Co. USA. 1948.
21. DA Cataldo, M Haroon, LE Schrader, VL Youngs. *Commun. Soil Sci. Plant Anal.* 1975, 6, 71-80.
22. PF Brownell. Sodium as an essential micronutrient element for plants and its possible role in metabolism in "Advances in Botanical Research". Woolhouse H.W. (Ed.) *Academic Press London*. 1979, 7, 117-224.
23. TR Peoples, DW Koch. *Plant Physiol*. 1979, 63, 878-881.
24. H Marschner. Mineral nutrition of higher plants. 2nd ed. Acad. Press Inc., London. 1997.
25. A Bez- Zinol, Y Vaadia, SH Lips. *Physiol. Plant.,* 1971, 24, 288-290.
26. DR Clarkson, RM Hanson. *Annu. Rev. Plant Physiol.* 1980; 31: 239-298.
27. K Mengel, EA Kirkby. Principles of Plant Nutrition. *Worblanfen-Bern, Switzerland: International Potash Institute*. 1982.
28. O Machold, O Stephan. *Phytochemistry*, 1969, 8, 2189-2192.
29. F. Skoog *Am. J. Bot*. 1940; 27, 939-951.
30. C. Tsui *Amer. J. Bot*. 1948; 35, 172-179.
31. W Haehnel. *Annu. Rev. Plant Physiol*, 1984, 36, 659-693.
32. AE Gallacher, JI Sprent. *Journal of Experimental Botany*, London, 1978, 29, 413-423.
33. CO Plank. Plant analysis Hand book for GeorgiaDocument Generated On: *1999-08-31: 9:45:01*. 1999, http://aesl.ces.uga.edu/docbase/publication/plant/plant.html
34. PK Bhargava, MN Khare. *Indian Phytopath*, 1988, 41(3), 363-366.
35. HG Gauch. Inorganic Plant Nutrition. Dowden, Hutchinson and Ross Inc. Stroudsburg, Pennsylvania. 1972
36. E Epstein. Mineral nutrition of plants: principles and perspectives. John Wiley and Sons Inc., New York, London, Sydney, Toronto. 1972.
37. BA Karadge. Physiological studies in succulents. Shivaji University, Kolhapur (India, 1981).
38. JA Patil. Ecophysiological studies in some Weedy species of *Cassia*. Shivaji University, Kolhapur (India, 2009).
39. KA Gole, DA Kadam, SN Jadhav, VT Aparadh. *International Journal of Pharmaceutical Research &Allied Sciences*, 2013, 2 (2), 70-75.
40. PR Stout. Micronutrients in crop vigoour. *Proc. 9th Ann. Calif. Fertilizer Conf.* 1961, 21-23.