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Estimation of Mineral Nutrient Concentration in *Datura Metel* and *Datura Innoxia Species*

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ABSTRACT

Datura plant which is known for hallucinogenic properties, grows luxuriantly on dumping yards and open fields. Generally, fruits are collected and traded in the local markets for medicinal purpose. To estimate the concentration of different elements, seeds and leaves of *D.metel* and *D.innoxia* were collected from Bengaluru city which is located in Southern part of India. Fruits and leaves collected from two species were dried in hot air oven. Seeds separated from fruits and grounded in to fine powder. Known weight of seed powder is digested with concentrated nitric acid and filtered. The samples were analyzed by using Flame Photometry and Inductive Coupled Plasma Mass Spectrometer (ICPMS). Micro and trace element quantity was recorded when reading was stable. Micro elements like K, Mg, Na, and Ca found in higher concentration in *D.innoxia* compared to *D.metel*. In Datura seeds Al, Mn, Fe, Cu and Zn are found at higher concentrations, whereas Li, Be, Si, V, Co, Au, Se, Mo, Ag, Cd and Sb occur in very low quantities in all the samples. The concentration of Ni, Zn, Cd, Pb, and Mo are higher than permissible limits given by World Health Organisation (WHO) standards. This data must be considered for further investigation to estimate the effectiveness of different *Datura* species for pharmacological purpose.

KEYWORDS *Datura*, mineral concentration, Flame Photometry, ICPMS

Introduction

Commonly found weed like plants may also have medicinal properties. One such plant is ***Datura*** which is generally identified as thorn apple. ***Datura***, which belongs to the family Solanaceae has a very special place in traditional systems of medicine. It has properties analogous to those of belladonna. Dried leaves, flowering tops and seeds are used in indigenous medicine in the treatment of asthma. The principle alkaloid of ***Datura*** is scopolamine, which is used as pre-anesthetic in surgery and child birth, ophthalmology and in the prevention of motion sickness. The seeds contain fixed oil with a disagreeable odor and taste (1). ***Datura*** is a heavy metal tolerant plant and can grow well in polluted regions (7). In situ Bioremediation process is enhanced by ***Datura*** plants, which will help in recovering toxic heavy metals from contaminated water (4,9). Four species of ***Datura*** can be very well identified in Deccan Plateau, namely ***D. metel, D. stramonium, D. innoxia,*** and ***D. ferox*** (5). All the four species grow very well in the deposited refuse of towns and villages. In the vicinity of Bengaluru, India, ***D. innoxia*** and ***D. metel*** are commonly occurring plants. Whereas ***D. ferox*** can be noticed only in few patches. ***D. stramonium*** is rarely seen over the hillocks, in the outskirts of townships. In South India, herbal collectors gather fruits of ***D. innoxia*** and ***D. metel*** to supply it to traders. Seeds were separated and traded in the market to traditional medicinal practitioners and drug manufacturers in the name ***of Datura*** (6).

The aim of this study is to determine the mineral nutrient content in two commonly found species namely, ***D. metel*** and ***D. innoxia,*** to understand the mineral nutrient accumulation capacity of two different species of the same genus from common habitat.

Hypothesis

- Concentration of nutrient elements in seeds are higher compared to leaves.
- Heavy metals accumulate in the plant as it grows luxuriously on dumping area.
- Concentration of different elements in ***D. metel*** and ***D.innoxia*** are similar as both the species are collected from same locality.

Methodology

The plant materials are collected from different locations, with in Bengaluru area, India. The city is in the heart of Deccan plateau at an average elevation of 920m and is positioned at 12.97^{0}N 77.56^{0}E. Fruits and leaves of two different species are separately collected between October to June and dried in oven. Seeds were separated by breaking the fruits and stored in moisture free containers. Analytical grade reagents and double distilled water was used throughout the experiment. All glassware and plastic containers were washed with liquid detergent, rinsed with water, soaked in 10% Nitric acid for 24 hours, cleaned thoroughly with distilled water and dried sufficiently to avoid contamination. The dried material was grounded in to fine powder and known weight of the powder (10g) is digested with concentrated Nitric acid. It is filtered and the filtrate was made up to 25ml.

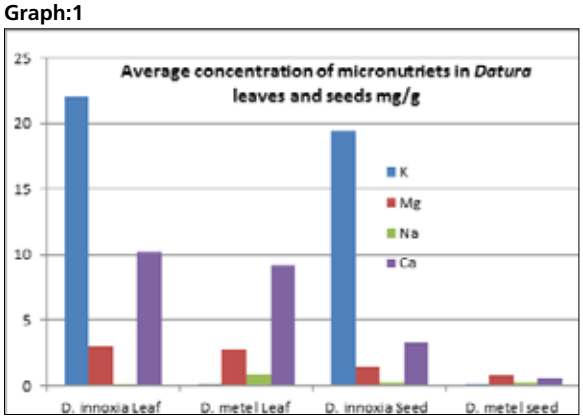
The samples were analyzed by Inductive coupled plasma mass spectrometer (ICP-MS). The instrument used was Perkin Elmer SCIEX ELAN® DRC-II, at National Geophysical Research Institute (NGRI), Hyderabad. The conventional pneumatic Meinhard® nebulizer, using a peristaltic pump with a solution uptake rate of about 0.8ml/min was used. The instrument was run in peak hopping mode, and all the samples were analysed for trace elements. NIST 1640 (National Institute of Science and Technology, USA) was used for calibrating the instrument for other trace elements since these standards have certified values for all elements studied. The detection limits for trace elements were in the range of about 0.01ng/ml and precessions were better than 6% RSD (Relative Standard Deviation) for trace elements. Single isotopes were used for all elements

and were selected based on their abundance levels and the freedom from interference from other elements usually present in samples. Other elements like Na, K, Ca and Mg were analysed by using Flame Photometry (Systronics Model) as these elements gets exited at minimum energy level.

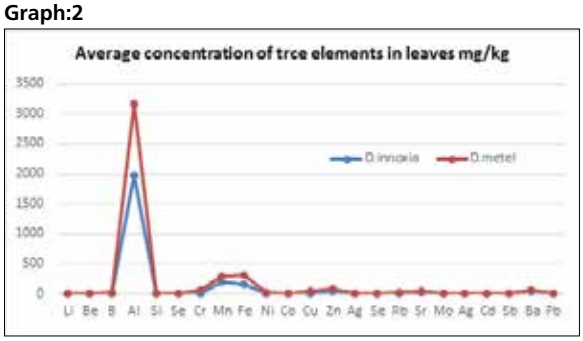
Results and discussion

Mineral composition analysis of leaves and seeds reveals that mineral concentration is rich in leaves compared to seeds. Major micronutrients like K, Mg, Na are found in higher concentration in ***D.innoxia*** compared to ***D.metel*** leaves and seeds. Higher concentration of Ca is found in case of ***Datura*** leaves except ***D.metel*** seeds (graph:1). Among other 23 minerals Al, Mn, and Fe are found in higher quantity in leaves of both the species. In ***Datura*** seeds Al, Mn, Fe, Cu and Zn are found at higher concentrations whereas Li, Be, Si, V, Co, Au, Se, Mo, Ag, Cd and Sb occur in very low quantities in all the samples. Higher levels of heavy metal concentration have been observed in all the samples (graph:2 & 3).

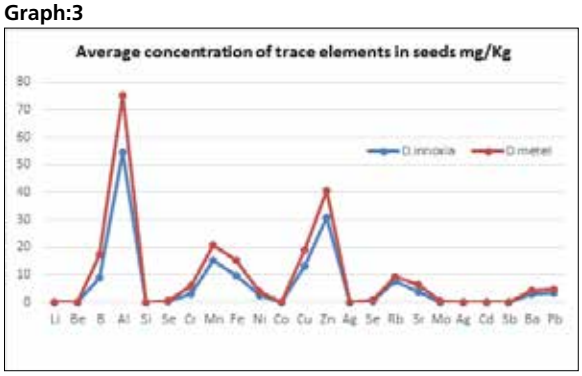
Graph:1



Graph:2



Graph:3



Conclusion

27 different mineral concentrations were analyzed among two species of ***Datura***. Minerals in biological materials like herbs are highly in homogeneous condition. Application of HNO_3 for mineralization of herbs leads to complete digestion of samples (3). Mineral composition analysis of seeds of two species reveals that in ***D.innoxia***, accumulation is much higher compared to ***D. metel.*** Concentration of K content is much higher in case of ***D.innoxia*** leaves (19.5 mg/g) compared to ***D. metel*** seeds (0.03mg/g). Calcium is 10.22 mg/g in ***D.innoxia*** leaves whereas, in ***D.metel*** seeds it is 0.56 mg/g. ***D. innoxia*** leaves and seeds shows higher levels of accumulation of all the 4 micronutrients compared to ***D.metel***. Li, Be, Si, V, Co, As, Se, Mo, Ag, Cd and Sb occur in very low quantities in all the 4 samples.

It is interesting to note that ***Datura*** leaves showed highest accumulation of Al, Mn and Fe while it is not the same in case of seeds. Higher level of heavy metal concentration has been observed in all the samples. Concentration of Ni, Zn, Cd and Pb and Mo are all above the guide line limits of WHO 2011 guidelines (2). It is found that higher level of accumulation of certain elements in these species may be due to predisposition of plants to accumulate certain amount of a particular mineral in various circumstances. The contents of major trace elements in plants are governed by geochemical features of the soil where the plant grows and by the ability of the plant to accumulate the nutrients selectively (8).

An attempt has been made to provide an exhaustive mineral composition among two ***Datura*** species, in view of bridging the existing knowledge gap. As we notice variation in the accumulation of mineral nutrients, it is necessary to investigate the effectiveness of these two species for pharmacological purpose. Harmful element like Arsenic is found at much higher level than the permissible standards. As the plant collection happens in the garbage dumping area, collectors should be educated to prevent gathering medicinal plants from polluted and refuse disposed places.

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