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Elemental Analysis (Mineral and Heavy metal) composition of *Phyllanthus amarus, Jatropha gossypifolia and Ruta graveolens*

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ABSTRACT

Phyllanthus amarus, *Jatropha gossypifolia* and *Ruta graveolens* are the medicinal plants selected for elemental analysis. *Phyllanthus amarus*, *Jatropha gossypifolia* belongs to Euphorbiaceae family while *Ruta graveolens* belongs to Rutaceae family. *Phyllanthus amarus* was tested for its moisture content, loss on ignition and ash, this ash was further used to analyze the mineral and heavy metals present in the plant using wet classical, atomic absorption spectrophotometric and flame photometric method. The results obtained thus revealed the presence of potassium, iron and calcium to be in higher amount, cadmium and arsenic were detected, however they were found in traces and lead was totally absent. Similar methods were used for analyzing mineral and heavy metal composition of *Jatropha gossypifolia* in which calcium and magnesium were found in abundance, arsenic and lead were in traces, whereas cadmium was not detected. In *Ruta graveolens* calcium, potassium and iron were in higher amount followed by magnesium, sodium, aluminium, phosphorus and silicon.

Keywords: *Phyllanthus amarus, Jatropha gossypifolia, Ruta graveolens,* Elemental analysis.

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INTRODUCTION

More than 40 elements have been considered essential to life systems for the survival of both mammals and plants. An element is considered essential when reduction of its exposure below a certain limit results consistently in reduction in a physiologically important function, or when the element is an integral part of an organic structure performing a vital function in that organism[1]. Active constituent of medicinal plants are metabolic products of plant cells and a number of trace elements play an important role in the metabolism [2] .The screening of the actual bioactive elements of plant origin and assessment of elemental composition of the widely used medicinal plants is highly essential. In present study an attempt was made to determine what essential elements are present and their levels in medicinal plants by using Atomic Absorption Spectrophotometer (AAS).

During the course of study of Phenylnaphthalene lignans we came across three different plants *Phyllanthus amarus* [3], *Jatropha gossypifolia* [4] and *Ruta graveolens* [5, 6] (L) containing similar type of lignans. Further studies with the plant extracts containing 1-Phenylnaphthalene lignans shows many biological activities. *Phyllanthus amarus* and *Jatropha gossypifolia* showed anticancer activity [7], while *Ruta graveolens* extract showed antiretroviral activity. [8-9].Encouraged by the outcome of many similar biological activities shown by these plant extracts, we next planned to investigate their metal contents for further drug formulations.

Geographical Distribution of *Phyllanthus amarus*

Phyllanthus amarus originates from tropical America and has spread as a weed throughout the tropics and subtropics. In tropical Africa it occurs in most countries. *Phyllanthus amarus* contains about 550 to 750 species in 10 to 11 subgenera [10]. In India, it is common as weed in gardens, fields and open sandy places and found is in villages, Balaghat, Bilaspur, Chhatarpur, Damoh, Dhar, East Nimar, Mandla, Panna, Raipur, Shivpuri, Sidhi, Tikamgarh[11].

Medicinal properties and Uses of *Phyllanthus amarus*

The plant is useful in jaundice, diarrhea, dysentery, intermittent fever, diseases of urino-genital system, scabies ulcer and wounds [12]. *Phyllanthus amarus* is used in the treatment for kidney/gallstones, other kidney related problems, appendix inflammation, and prostate problems [13]. According to Foo and Wong[14], in a number of countries, the aerial part of *Phyllanthus amarus* is highly valued in traditional medicine for its healing properties. This plant is traditionally used around the world in the treatment of liver ailments and kidney stones. The Spanish name ‘chanca piedra’ means “stone breaker or shatter stone.” In South America, ‘chanca piedra’ has been used to eliminate gall bladder and kidney stones, and to treat gall bladder infections. *Phyllanthus amarus* has also shown to work as an antifungal, antibacterial and antiviral agent [15]. In India, this plant is used in traditional medicine to treat liver diseases, asthma and bronchial infections [14].

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Geographical Distribution of *Jatropha gossypifolia*

A native of Brazil, normalized in many parts of India [16]. It has also naturalized in most tropical area of the world. Ecology, it grows on nearly all types of soils within its range. It is common in waste lands, roadsides, poorly tended agriculture fields and river overflow area. Reproduction: Flowering in India occurs from February to July. Sometimes both flowers and fruits will be present at the same time on the plant. Upon drying, the capsule valves spring open propelling the seeds a few centimeter [17].

Medicinal properties and Uses of *Jatropha gossypifolia*

Jatropha gossypifolia linn finds frequent use in the Indian traditional medicine. The extract of the plant are used as a purgative and emetic, to treat headache, diarrhoea, venereal diseases, skin sores, mouth sores and cancer [17]. The plant is reported to be beneficial to dyscrasia, anemia, vertigo and dysphonia [16]. It is used to treat urinary complaints and as an antifertile agents [18]. Decoction of the bark finds use as an emmenagogue [18]. The latex is applied to ulcers and lepromae [18]. The seed oil is used as an emetic, purgative and stimulant. It is also applied for ulcers and leprosy and is beneficial in adenites and worm infestation [19]. The roots are recommended for leprosy and as an antidote for snake bite [16, 18]. Its most important application has been reported to be in the treatment of cancerous growth [20, 7].

Geographical Distribution of *Ruta graveolens*

It is native to Europe, specially the Mediterranean region, but widely distributed into all the temperate and tropical regions. It is a very popular and attractive garden shrub in South America, where it is grown not only for ornamental and medicinal reasons but also because of the belief that it provides protection against evil [21].

Medicinal properties and Uses of *Ruta graveolens*

Rue is primarily used to stimulate the beginning of the menstruation flow, to treat hysteria, epilepsy, medical disorder of brain, colic, nausea, intestinal worms, poisoning, as well as eye problems. It increases peripheral blood circulation and relieves eye tension. Rue is also said to have anti-spasmodic properties. It is also taken for coughs, stomach aches and flatulence [22].

MATERIAL AND METHODS

Plants collection and sample preparation

The plants *Phyllanthus amarus* Schum & Thonn , *Jatropha gossypifolia* (L) and *Ruta graveolens* (L) were collected from Shree Shail Medifarms, Nagpur and authenticated from the Deptt. of Botany, RTMNU, Nagpur. The specimen voucher numbers are 9460, 9461 & 9605. The

whole plants were air-dried and milled into powder with electrical grinder and finally stored in airtight bottles before analysis.

EXPERIMENTAL

The plants were tested for its moisture content, loss on ignition and ash. This ash was further used to analyze the minerals and heavy metals present in the plants.

1. Moisture Content : 10 g of plant samples were taken in a silica Petri-dish and recorded as wet weight of sample, then place this Petri-dish in oven at 110^{o}C for 2 hours and allow the sample to cool in a "Silica Gel Blue" dessicator. Weigh the cooled sample again, the loss is reported as moisture.

2. Loss on Ignition (LOI): Same Petri-dish is placed in furnace and temperature is gradually raised to 500^{o}C, after 2 hours temperature was raised to 950^{o}C and sample was placed for 1 hour at same temperature. Sample was then cooled and weighed; loss is reported as loss on ignition.

3. Ash: Unburnt matter in the above process of determination of LOI is reported as ash, this ash was further analyzed by various techniques (wet classical, atomic absorption spectrophotometric method and flame photometric method).

Moisture content, LOI and ash content for PA = 5.34%w/w, 61.99%w/w and 38.01%w/w
Moisture content, LOI and ash content for JG = 9.0%w/w, 86.73%w/w and 13.27%w/w
Moisture content, LOI and ash content for RG = 6.90%w/w, 88.86%w/w and 11.14%w/w

Elemental Analysis

The ash contents of the plants were analyzed for its mineral and heavy metal composition [23] using wet classical, AAS, Flame photometric method.

The results obtained for *Phyllanthus amarus* revealed the presence of potassium, iron and calcium to be in higher amount. Cd and As were detected, but were found to be in traces, lead was totally absent. Calcium and Magnesium were found in abundance in *Jatropha gossypifolia* followed by Al, P, Fe & K. *Ruta graveolens* showed high content of K, Fe and Ca.

Mineral and heavy metal composition of *Phyllanthus amarus*, *Jatropha gossypifolia* and *Ruta graveolens* are listed Table 1.

RESULTS AND DISCUSSION

Elemental analysis of *Phyllanthus amarus* and *Ruta graveolens* has revealed that the plants have high content of potassium, iron and calcium which is related to the plants alleged used as tonic and in the treatment of oedema and kidney disorder. Iron in plants is necessary

for chlorophyll formation and for oxygen transfer, whereas potassium in plants promotes general vigor, disease resistance and sturdy growth. Plant *Jatropha gossypifolia* has higher content of calcium and magnesium which in turn is useful for regulation of heart beat, muscle contraction and nerve conduction. Ca and Mg belong to the group of parasympathetic elements that exhibit anti-inflammatory properties at higher amount. Phosphorus is important in germination and growth of seeds, production of flowers, fruit and growth of roots.

Table 1: Mineral and Heavy metal Composition of *Phyllanthus amarus, Jatropha gossypifolia and Ruta graveolens*

Elements	Na	K	Fe	Ca	Mg	Al	P	Cd	As	Pb
Phyllanthus amarus Composition	0.86%	12.84%	10.68%	6.57%	0.34%	3.92%	0.34%	8 (ppm)	12 (ppm)	Not detected
Jatropha gossypifolia Composition	0.25%	3.24%	3.53%	17.31%	6.28%	4.25%	3.71%	Not detected	14 (ppm)	400 (ppm)
Ruta graveolens Composition	0.22%	1.60%	0.53%	3.29%	0.22%	0.21%	0.18%	-	-	Trace

CONCLUSIONS

An increasing reliance on the use of medicinal plants in the industrialized societies has been traced to the extraction and development of several drugs and chemotherapeutics from the plants as well as from traditionally used rural remedies. Moreover in these societies herbal remedies have become more popular in the treatment of minor ailments on account of the increasing cost of personal health maintenance.

Medicines contain trace elements in a bioavailable form. The data obtained in the present work on elemental compositions of the medicinal plants will be useful in deciding the dosage of the drugs prepared from these plants and thus will be helpful in the synthesis of new drugs which can be used for the control and cure of various diseases.

Apart from this, data on the contaminant levels of heavy metals highlights the necessity on the quality and safety concerns about their use.

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REFERENCES

[1] Armah YS, Nyarko BJB, Akaho EHK, Kyere AWK, Osae S, Boachie KO Osae EK. J Radioanalytical Nuclear Chem 2001; 250(1): 173-176.

[2] Rajurkar NS, Damame MM. J Radio-analytical Nuclear Chem 1997; 219(1): 77-80.
[3] Maciel MAM, Cunha AF, Dantas TNC, Kaiser CR. Ann Magn Reson 2007; 6(3):76-82.
[4] Das B and Benerji J. Phytochemistry 1988; 27(11):3684.
[5] Cho JY, Kim AR, Yoo ES, Baik KU, Park MH. J Pharm & Pharmacol 1999; 51:1267.
[6] Cho MK, Jang YP, Kim YC, Kim SG. Int Immuno Pharmacol 2004; 4: 1419.
[7] Hartwell JL. Plants used against cancer. A survey Quarterman Publications Lawrence, M.A 1982.
[8] Summers J, Mason WS. Cell 1982; 29: 403.
[9] Misra M, Misra AN. Int J Pure Appl Sci Tech 2010; 1(1): 11.
[10] Unander DW. Webster GL and Blumberg BS. J Ethnopharmacol 1995; 45: 1-18.
[11] Mudgal V, Khanna KK, Hajra PK. Fl & Fr :Aug – Dec. Flora of Madhya Pradesh Vol II, Botanical Survey of India.
[12] Kuber VV, Chawla JL, Sane RT. Indian Drugs, 1997; 34(1):36-42.
[13] Heyde H. Medicijn planten in Suriname. (Den dresi wiwiri foe Sranan). "Medicinal Plants in Suriname." Uitg. Stichting Gezondheidsplanten Informaite (SGI) Paramaribo. 1990; 157.
[14] Foo LY and Wong H. Phytochem 1992; 31(2): 711-713.
[15] Houghton PJ, Woldemariam TZ, O'Shea S and Thyagarajan SP. Phytochem 1996; 43: 715-717.
[16] Kirtikar KR and Basu BD. Indian Medicinal Plants 1980; Vol III, 2247.
[17] Parrotta JA. Healing plants of Peninsular India, CABI Publishing, Wallinford, UK and New York, 2001; 917.
[18] Sastry BN. The Wealth of India (Raw Material), Vol V, Council of Industrial and Scientific Research, New Delhi, 1959; 295.
[19] Banerji J, Das B, Bose P, Chakabarti R and Chaterjee A. Traditional Medicine, Oxford and IBH Publishing Co. Pvt, Ltd, New Delhi, 1993; 352.
[20] Hartwell JL. Lloydia 1969; 32, 153.
[21] Junghanns KT, Kneusel RE, Gröger D, Matern U. Phytochem 1998; 49(2):403-11.
[22] Montvale NJ. PDR for Herbal Medicines, Medical Economics Company, 1998; 1108.
[23] Chidi U Igwe, Linus A Nwaogu and Cosmos O Ujuwondu. African J Biotechnol 2007; 6(6):728-731.