ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

# Evaluation of Elemental Profile of *Tecomella undulata* (Seem): An Endangered Medicinal Plant.

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**ABSTRACT**

Desert teak or Tecomella undulata (Seem) is one of the important medicinal plant of Rajasthan, India. The aim of the work was to determine the elemental composition , Copper (Cu), Znic (Zn), Manganese (Mn), Iron (Fe), Calcium (Ca), Chromium (Cr), Sodium (Na), Nickel (Ni), Lead (Pb) and Cadmium (Cd) in different parts (leaf, bark and flower) of the plant Tecomella undulata (Seem). All elemental estimations were done using Inductively Coupled Plasma - Atomic Emission Spectrometer. The results were discussed with reference to established role of elements in physiology, Metabolism and pathology of human life. Tecomella undulata (Seem) had adequate amount of Cu, Zn, Mn, Fe, Ca, Cr, Na, Ni, and Pb. It can be concluded that the plant has significant amount of Fe, Ca and Zn thus can be used as an alternative to natural diet supplement and simultaneously gives an idea for deciding dosage of Ayurvedic drug prepared from this plant.

**Keywords:** Tecomella undulata (Seem), ICPES, Elemental composition.

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ISSN: 0975-8585

## INTRODUCTION

Minerals are the sparks of life, without minerals we would not be able to function efficiently. They are the driving forces for enzymes and hormones; are an integral part of cells, tissue, bone, blood and body fluids. They also assist in almost every aspect of life; be it be the production of hormones or energy, helping in digestion, enabling nerve impulse transmission, muscle contraction, help in the regulation of pH, governing metabolism, controlling cholesterol and blood sugar levels. Macro minerals and trace minerals although do not supply any energy nor fuel to the body yet they are instrumental in their production of energy and their use. All vitamins will not work adequately in the absence of minerals and thus will be of no use.

Plants are the richest source of the elements which are essential to humans and thus plant foods contribute significantly to human nutrition and health. However, nutrient composition varies among different plants and is present in different forms. There is no direct link that has been established between elemental content and curative capability of the plant. But such studies will help us to understand the pharmacological action of the plant and thus provide the vital link between the two. [1,2]

The present study is on Tecomella undulata (Seem) which is a very important medicinal plant of Rajasthan, India. Tecomella undulata (Seem) , commonly known as Rohida (Hindi), Rohitaka (Sanskrit) and Ammora (English). Due to its presence in arid and semi-arid regions of Thar desert, it is also known as Desert teak. Locally it is popularly known and traded by the name of Marwar teak or Desert teak. Tecomella is famous for its quality timber; use of its leaves, flowers and pods as fodder; and its secondary metabolites having therapeutic properties.

It is also referred in great epic Mahabharata and its therapeutic uses are also mentioned in Ayurveda [3,4]. Pharmacological activities having phytochemicals like flavonol [5], triterpenoids [6] phytopsterols [5], napthoquinone [7,8] iridoid glucoside [9] etc are already been identified. It is used in the treatment of several diseases like hepatitis [10], syphilis, gonorrhea, conjunctivitis. It also acts as a blood purifier, have antioxidants [11], anti-inflammatory [12], antibacterial and analgesic activities [13,14]. Mixtures of medicinal plants are prescribed by the traditional healers for diseases ranging from common colds to malaria, arthritis, ulcers, etc. and they can cure humans from deadly diseases like AIDS and cancer also[15] Tecomella undulata (Seem) leaves have oleanolic acid, ursolic acid and betulinic acid compound that have strong HIV prohibitors. Octadimethyl succinate derivatives of oleanolic acid and betulinic acid have been reported to have 24 times more active than AZT (a drug currently used in AIDS)[16] . Including all this medicinal properties Tecomella undulata (Seem) can be a good source of minerals which is required for structural and functional integrity of the living cells and organisms.

However, medicinal plants also contain toxic elements; if not taken care of or consumed in wrong dosages may cause serious problems. Lack of knowledge of the elemental constituents of this medicinal important plant often poses danger to consumers as many of them take overdose to speed up healing is highly elevated, ignorant of the dangers in doing so. [17] Thus, screening of the elemental composition of these medicinal

plants is highly essential. [18]. According to WHO, medicinal plants should be checked for the presence of heavy metals. It is an established fact that the overdose or prolonged ingestion of the medicinal plant leads to the chronic accumulation of different elements which cause various health problems. [19, 20]

The literature survey indicates that not sufficient work is carried out in elemental profiling of Tecomella undulata (Seem). Therefore, present study is based on determination of mineral elements from various Aerial parts of Tecomella undulata (Seem) and their therapeutic uses in human health life.

## MATERIALS AND METHODS

### Plant collection

Fresh plant parts were collected from Nagaur, Rajasthan, India in the month of December 2012 –January 2013. The plant was identified and authenticated at Blatter's Herbarium, St. Xavier's College, Mumbai. (Accession No 22800).

### Plant Material

The plant parts were sorted out and surface contaminants of plant samples were removed by washing with mild detergent followed by rinsing with deionized water. After that the material was air dried and then homogenized to fine powder. The powder was stored in air tight glass containers and used for further analysis.

### Sample Preparation

Two gram powder of each plant part was dissolved in nitric acid and heated until the reddish brown fumes disappear. Perchloric acid was then added to the above solution and heated for 5 min. This was followed by addition of aqua regia and heated .The volume was then made up to 25ml in a standard flask by adding de ionized water.

### Elemental analysis

Estimation of essential and trace elements like Cu, Zn, Mn, Fe, Ca, Cr, Na, Ni, Pd and Cd was carried out using Inductively Coupled Plasma - Atomic Emission Spectrometer (ICPES), (Model: ARCOS from M/s. Spectro, Germany).

## RESULTS AND DISCUSSION

The result of elemental composition of different plant parts is given in Table no.1 which shows Tecomella undulata (Seem) is a good source of trace and macro minerals. Flower content more elements compared to other plant parts. The Only element which is more in leaf compared to bark and flower is sodium and calcium is abundant comparitively in bark than other parts. So on an average Flower contains more elemental concentration. Importance of minerals, deficiency disorders, advised intake and permissible limits is mentioned in the table no.1.

ISSN: 0975-8585

**Table1: Elements, their uses, deficiency disorders, advised intake and permissible limits along with contents present is Tecolmella Undulata (seem)**

| Uses | Deficiency | Permissible limits | Conc in (ppm) |
|---|---|---|---|
| **COPPER** | | | |
| It is component of enzymes which are involved in reducing molecular oxygen; metabolizing histamine, serotonin, epinephrine, norepinephrine, and dopamine; oxidize ferrous iron and facilitate the binding of iron to transferring. | Deficiency results in a hypochromic anemia and may also reduce bone density. | Edible plants<br>3ppm(31)<br>Medicinal plants<br>20 ppm.(32) | L=0.313<br>S=0.346<br>F=0.718 |
| **ZINC** | | | |
| Zinc is an essential component of various enzymes | Deficiency in children causes impaired growth; in case of women causes poor pregnancy & immune functions. | Ediable plant<br>27.4 ppm.(31)<br>Medicinal plants<br>Not decided<br>Dietry intake<br>8 mg/day for women<br>11 mg/day for men(33) | L=1.885<br>S=1.128<br>F=6.308 |
| **MANGANESE** | | | |
| component of numerous enzymes involved in bone formation and in the metabolism of amino acids, lipids, and carbohydrates[22] | Manganese deficiency has been reported in animals but rarely in humans. | Edible plants<br>2ppm<br>Medicinal plants<br>have not yet been set(32)<br>Dietry intake<br>1.8 mg/day for women.<br>2.3 mg/day for men(33) | L=1.288<br>S=1.563<br>F=2.794 |
| **IRON** | | | |
| It is component of hemoglobin, and numerous other proteins and enzymes. | deficiency results in anemia, adverse pregnancy outcomes, developmental delays and impaired physical work performance.[24] | Edible plants<br>20 ppm. (31)<br>Medicinal plants Not decided yet<br>Dietry intake<br>27 mg/day for pregnant woman; 18 mg /day for childbearing women and 8mg/ per day for men(33) | L=35.379<br>S=68.045<br>F=99.974 |
| **CALCIUM** | | | |
| Necessary for nerve impulse transmission, muscle contraction, glandular secretion, and blood vessel contraction and dilation; integral component on Bones, teeth and Blood | Deficiency causes bone mass reduction; osteoporosis development. | 500-800mg/day, for 1-8 years children; 800 mg/day for 4-8 years, 1300 mg/day for 9-18 years;<br>1000 mg/day for 19-50; 1200 mg /day for >50 years.(33) | L= >602.02<br>S= >1308.31<br>F= >142.046 |
| **CHROMIUM** | | | |
| It enhances the insulin's action and thus plays a role in glucose metabolism | Deficiency leads to improper Glucose utilization and increased insulin requirements. | Edible plants<br>0.2 ppm(32)<br><br>Medicinal plants<br>2 ppm in raw medicinal plant material and 0.02 mg/day in finished herbal products WHO (28) | L=0.554<br>S=0.683<br>F=8.503 |

ISSN: 0975-8585

| | | | |
|---|---|---|---|
| **SODIUM** | | | |
| It is major electrolyte of the blood;helps in keeping body hydrated.[25] | Too much sodium will cause the cell to break down. | 2.4 g/day[26]<br>Not enough knowledge. | L=45.015<br>S=4.126<br>F=14.617 |
| **NITROGEN** | | | |
| Some studies shows that it is not general agreement that it is necessary in human nutrition. | chronic exposure has been connected with increased risk of lung cancer, cardiovascular disease, neurological deficits, developmental deficits in childhood, and high blood pressure. [31] | Edible plants<br>1.63 ppm(31)<br><br>Medicinal plants<br>Not decided yet. | L=0.236<br>S=0.204<br>F=4.751 |
| **LEAD** | | | |
| Pd is a non-essential element and it has no such functional role in human life. | Inhibit several key enzymes.[27] | Edible plants<br>0.43ppm. (31)<br><br>Medicine plants<br>10 ppm (32) | L=0.085<br>S=0.072<br>F=0.084 |
| **CADMIUM** | | | |
| Cadmium is toxic metal having functions neither in human body nor plants. [29] | Accumulation of Cd in kidney leads to high blood pressure and renal diseases. | Edible plants<br>0.21 ppm. (31)<br><br>Medicinal herbs<br>0.3 ppm. and 0.006 mg/day in the WHO [32] | L= <0.01<br>S= <0.01<br>F= <0.01 |

[L= Leaf; S= Stem Bark; F= Flower]

**Table 2: Elemental composition of Tecomella undulata by using ICPES**

| Plant Part | Minerals Concentration in ppm | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cu | Zn | Mn | Fe | Ca | Cr | Na | Ni | Pb | Cd |
| Leaf | 0.313 | 1.885 | 1.288 | 35.379 | >602.02 | 0.554 | 45.015 | 0.236 | 0.085 | ND |
| Stem-Bark | 0.346 | 1.128 | 1.563 | 68.045 | >1308.31 | 0.683 | 4.126 | 0.204 | 0.072 | ND |
| Flower | 0.718 | 6.308 | 2.794 | 99.974 | >142.046 | 8.503 | 14.617 | 4.751 | 0.084 | ND |

(ND—values less than 0.01 ppm )

**FIGURES: Elemental concentration of Tecomella undulata (seem) in different Aerial parts (X- axis –minerals and Y-axis mineral amount in palm).**

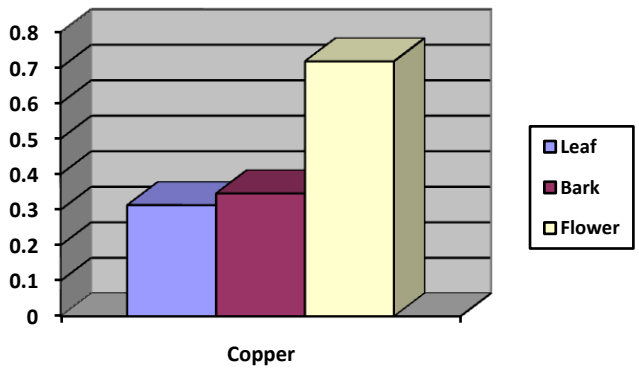


**Figure 1: Concentration of Copper in different plant parts**

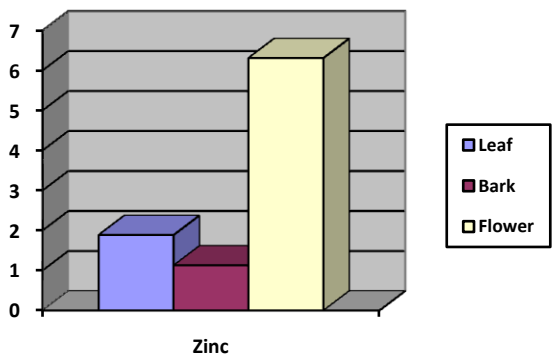


**Figure 2: Concentration of Zinc in different plant**

ISSN: 0975-8585

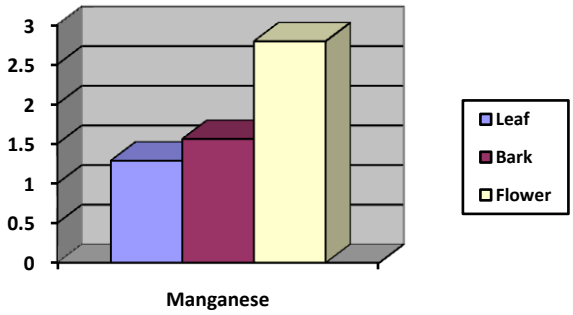


Figure 3: Concentration of Manganese in different plant parts

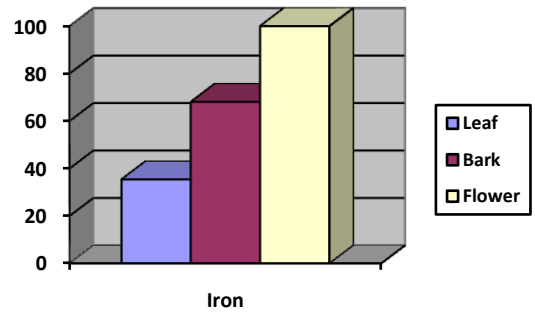


Figure 4: Concentration of Iron in different plant

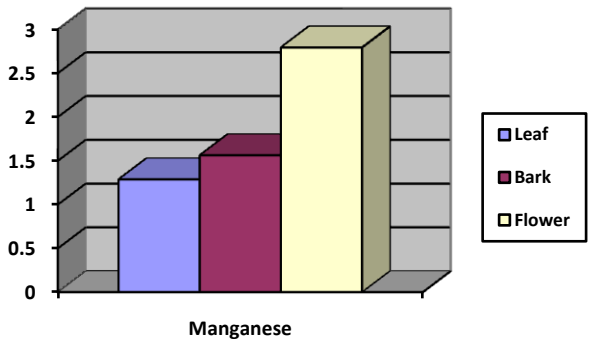


Figure 5: Concentration of Sodium in different plant parts

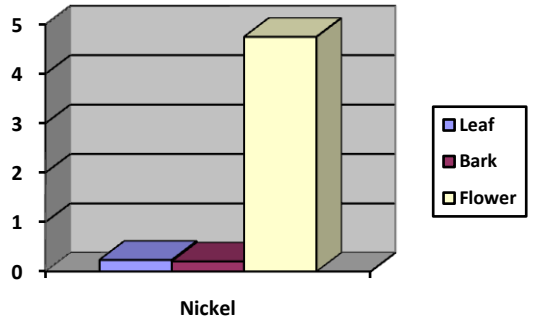


Figure 6: Concentration of Nickel in different plant

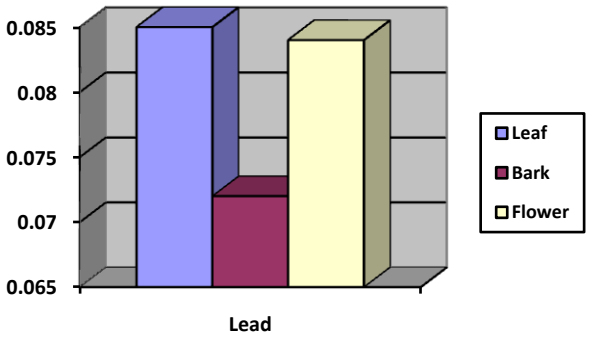


Figure 7: Concentration of Lead in different plant parts

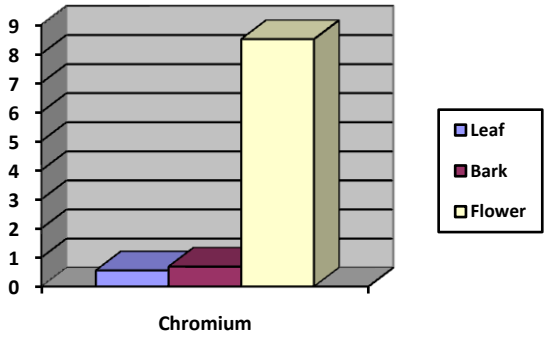


Figure 8: Concentration of chromium in different plant

## CONCLUSIONS

Based on these observations, the data are discussed in the light of current literature and following conclusions are drawn. Tecomella undulata (Seem) is a rich source to Calcium and iron and shows negligible amount of cadmium.

The concentration of chromium and iron is exceeding the limit for edible plants but all other elements are below the WHO permissible level.The excees concentration is may be due to soil and climatic condition. In this dirction research can be carried out.

All these plant parts may be a good source of mineral to treat number of diseases that are mainly caused due to the deficiency of those minerals and can be utilized in Ayurvedic system to cure disease. Tecomella also has adequate amount of Zn, Mn and Na. Nowadays a common problem is seen in women that is deficiency of calcium but Tecomella

undulata (Seem) bark is providing a good alternative to cure this problem as it has more then 1308.31ppm concentration. Simultaniously sodium which is required at blood level as it is major electrolyte is also present in adequate amount 45.015 ppm in leaf. As Tecomella has elements in ample amount, it can be used as a good natural dietary supplement as well as therapeutic uses also.

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