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NOTE

High Accumulation of a Heavy Metal in *Ravenelia esculenta*: an Edible Rust

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Ravenelia esculenta, an edible rust infecting *Acacia eburnea* is consumed with relish in Maharashtra. Metal analysis of the host and parasite showed high percentage of aluminium in the parasite namely *Ravenelia esculenta*. So more consumption of this rust may lead to metabolic disorders such as Alzheimer's disease, Parkinsonism etc. in human beings.

Key Words: *Ravenelia esculenta*, *Acacia eburnea*, Heavy metal, Aluminium.

Ravenelia esculenta Naras. and Thirum, commonly called 'Murmuti'—an edible rust, infects *Acacia eburnea* Willd in the arid and semi arid parts of Maharashtra State, India. People in this area use this rust as a vegetable. Due to this infection thorns, peduncles, buds, flowers and pods show 10 to 15 times hypertrophy completely changing the morphology of these parts. The hypertrophoid parts become tender, succulent, green having bizarre shapes. The hypertrophy is due to aeciospores and in severe instances of infection brown, dome-shaped aecial cups become prominent.

In the words of the late Dr. Henry Schroeder[1], "Minerals are the basic spark plugs in the chemistry of life, on which the exchanges of energy in the combustion of foods and the building of living tissue depend." Even though the essential minerals are necessary in adequate amounts for health, the presence of an imbalance between the minerals is known to contribute to health problems. Mineral deficiencies and imbalances are known to affect and be involved in disorders of the cardiovascular system, gastrointestinal, muscular, skeletal, neurological, immune and endocrine systems. The excessive accumulation of the minerals can also prove detrimental. Therefore, their balance within the body is proving just as important as their individual levels. So the rust—*Ravenelia esculenta*—was screened for metal contents along with the host—*Acacia eburnea*.

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Atomic absorption spectrophotometer used was of Chemito 201 mech. Flame Photometer used was of Chemito mech. AR grade hydrochloric acid was used.

Ash of the healthy and infected materials was prepared by taking 1 g of each sample and keeping it in muffle furnace at 550°C till constant weight was obtained. The major constituents of ash were determined qualitatively and quantitatively. For the detection of metals the ash was converted to chlorides and the solution was tested for metals by applying standard procedures. Initially the ash was dissolved in 10% HCl (5 mL) and evaporated to dryness on a water bath. Again 10% HCl (0.5 mL) was added and evaporated to dryness. The material was digested with 25% HCl (5 mL) on a water bath for 30 min. The resulting solution was filtered through Whatman paper (no. 40). The residue was made chloride free (tested with silver nitrate) by giving washings with hot water. The filtrate was diluted to 100 mL and used to estimate metal contents by using standard methods as illustrated in Table-1[2].

TABLE-1

Particulars	Method used	Healthy sample	Infected sample
Acid soluble ash (g)		0.0469	0.0515
Acid insoluble ash (g)		0.0052	0.0116
Metals (%):			
Fe	Atomic absorption spectrophotometer	0.8742	0.7474
Ca	Flame photometer	20.2559	16.6505
Mg	Atomic absorption spectrophotometer	23.0531	6.8964
K	Flame photometer	53.3050	34.5200
Al	Titrimetry	0.5205	15.5340

Total ash content of the infected material was 1.1 % more than that of healthy material. This showed increase in metal content in the infected material. Double the amount of acid insoluble ash of the infected material may be attributed mainly to increased quantity of silicates along with phosphates, sulphides, oxides etc.

Metal analysis of acid soluble ash of infected and healthy material showed the presence of iron, calcium, magnesium, potassium and aluminium as major constituents. Percentage of all the metals except aluminium was decreased in the infected material. Aluminium content of the infected material was excessively increased (by 15.1135%) **(Table-1).**

In the present study, more importance was given to the metal analysis of the infected material as it is extensively used as a vegetable in some parts of Maharashtra, India. The percentage of metal contents except aluminium in the infected material was decreased as compared to healthy material. However, the quantities of metals in the edible rust have nutritional values.

Iron plays an important role in the transport of oxygen from the lungs to the tissues. It is also used in the manufacture of haemoglobin. Iron plays an important role in normal immune function. A deficiency of iron may cause anaemia,

coordination problems, attention, learning and memory difficulties and susceptibility to infection[3].

Calcium is essential for transmission of nerve impulses that control muscle contractions, binding together of cells to form organs, production and activity of enzymes and hormones that regulate digestion, fat metabolism, energy release and saliva production, clotting of blood to initiate wound healing[3].

Magnesium is essential to the production, storage and use of energy from fat and sugar. It is vascular dilating, bronchodilating and helps to regulate nerve cell function. It is essential for bone formation and metabolism, regulating the heart rate and rhythm. It maintains blood lipid homeostasis, heart muscle. It prevents kidney stone formation. It is involved in blood clotting mechanisms and has many other functions[3].

Potassium is essential for maintaining the balance of body fluids, transmitting nerve signals, insulin release and muscle contraction. Potassium deficiency may produce symptoms of fatigue, weakness, mental depression, abnormal heartbeat and irregularities in the ECG, dry skin, glucose intolerance, low blood pressure, muscle cramps etc[3].

All these essential minerals are present in *Ravenelia esculenta* and thus it has nutritional value. However, it is lessened due to high percentage of aluminium. Aluminium has only recently been considered a problem mineral. It is not really a heavy metal as it is low in molecular weight—so it does behave differently from metals such as lead or mercury. Recent investigations, however, implicate aluminium toxicity in Alzheimer's disease, Parkinsonism and other brain and senility syndromes[3]. Thus consumption of this rust as a vegetable may prove hazardous to health.

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