FIRST INTERNATIONAL CONFERENCE
«INTEGRATION NETWORK OF THE PHARMACEUTICAL ECOLOGY
IN THE MODERN ENVIRONMENT - 2023»
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Assessment of Heavy metals in Bacopa monnieri raw plant material

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Significance Statement
The content of heavy metals is a **mandatory indicator** of the **safety** of using medicinal plant raw materials and medicines.
There are currently four regulated heavy metals: **Pb, As, Hg** and **Cd**.
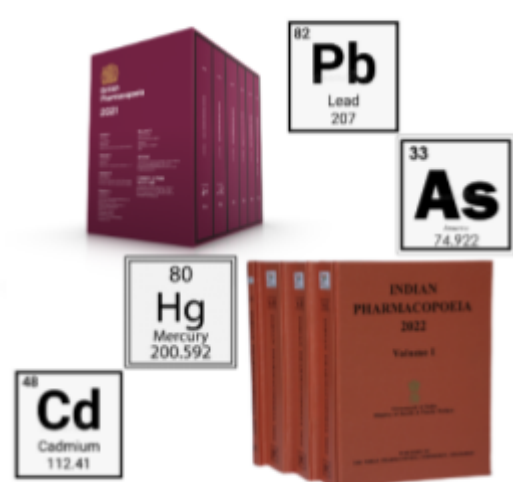
***Bacopa monnieri* (Linn.) (*Plantaginaceae*)**
Ecologically significant properties of the species
It is well-adapted to growing in areas polluted with heavy metals and can accumulate toxicants (**Hg, Pb,Cd** etc.). Brahmi raw plant material is used in Ayurveda as a nootropic drug in the form of extracts and oils, as well as in recipes such as Brahmi bati baidyanath, Brahmi vati dabur etc.

Goal of research: assessment of heavy metals in *B. Monnieri* whole plants.
Objectives of the study:
1. Assess the content of heavy metals in raw plant material (powders from different regions).
2. Assess the level of pollution in medicines from different regions. 3. Assess the content of toxic elements.

Objects of study:
- *B. monnieri* dried **whole plants**
- *B. monnieri* **powder**
(Hassan and Varanasi, India).
Method: determination of heavy metals using atomic adsorption spectroscopy.
The content of 11 metals was determined in the samples
(As, Bi, Cd, Ni, Pb, Co, Fe, Mn, Zn, Cu, Cr).

The concentration of elements, ranked from highest to lowest, was found to be:
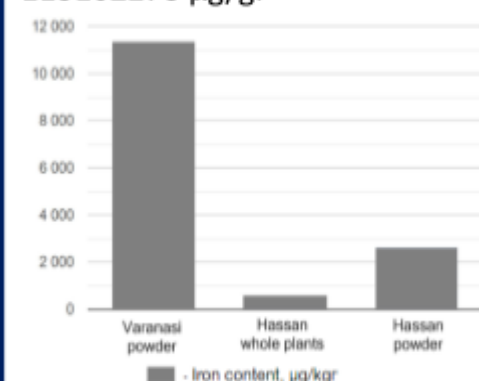**Fe > Mn > Zn > Cu > Cr > Co.**
Cobalt was not present in all the samples. Its content in the powder from Hassan was found to be 1.85±0.1 µg/g, while the other samples contained no **Co**.
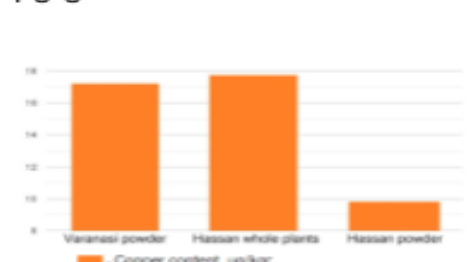No toxic elements or microelements (**Bi, Ni**) were found.

**Out of all the microelements, iron was the most common metal.**
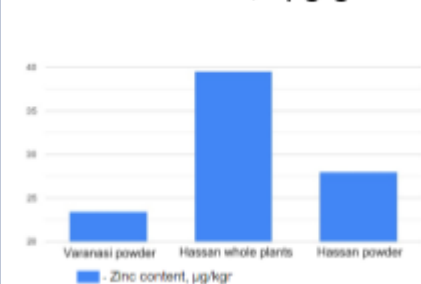The range of content varied between 580.1±9,6 and 11310±278 µg/g.

The content of **copper** in the powder from Varanasi and the whole plants from Hassan was roughly the same.The range of content varied between 9.8±.2 and 17.7±0.8 µg/g.

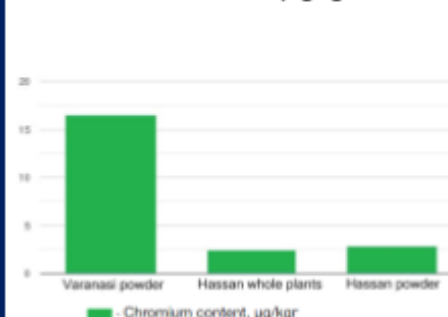**The second most common** metal was **manganese**.The range of **Mn** content varied between 49.5±1.0 and 11310±278 µg/g.
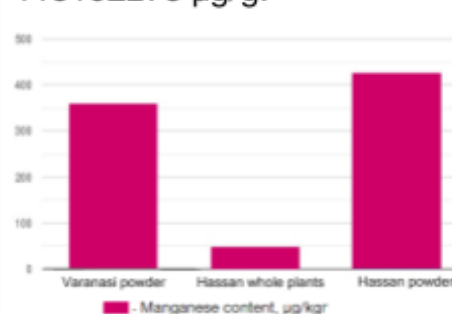
The content of **zinc** was the highest in whole plants of Brahmi from Hassan. Range of content: between 23.5 ±0.3 and 39.5±0,4 µg/g.

Chromium was the most toxic metal. The range of content varied between 2.4 ±0.1 до 16.5±0.1 µg/g.

Regulatory document	Heavy metal content, no more than			
	Pb	Cd	Hg	As
Indian Pharmacopoeia	Sum of heavy metals no more than 20 ppm			
British Pharmacopoeia	5.0 ppm	1.0 ppm	0.1 ppm	-
The Ayurvedic Pharmacopoeia of India	10 ppm	0.3 ppm	1 ppm	3 ppm
The State Pharmacopoeia of the Russian Federation	6.0 mg/kg	1.0 mg/kg	0.1 mg/kg	0.5 mg/kg

The study has demonstrated that Bacopa whole plants contained the highest amounts of **Fe, Mn** and **Zn** and the lowest amounts of **Co** and **Cu**.
It has been determined that heavy metals are accumulated in larger amounts in the environment of **Varanasi**, which is associated with the industrial development of the region, as well as the prevalence of alluvial soils rich in hummus and iron.

Raw materials from different regions vary in heavy metal content. Depending on where the medicines are manufactured, the content of elements tends to differ. Iron content in Brahmi is roughly 100 times higher than that in whole plants harvested in Russia, which corresponds with the soil data.
A comparative analysis of publications has demonstrated the acceptability of the raw plant materials in terms of heavy metal content in herbs.