

# Mineral Nutrition in the Leaves of *Cocculus hirsutus* (L) Under Pathogenesis

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## ABSTRACT:

The present research paper deals with mineral content in the leaves of *Cocculus hirsutus*(L) affected by powdery mildew fungus *Oidium Sp.* (Imperfect stage). The healthy and infected leaves were digested by tri-acid, prescribed by Toth *et al.*, (1948) method. The digested sample was further subjected to Inductive Coupled Plasma Optical Emission spectroscopy. ICP-OES (Agilent 5800ICP-OES FEQ'S), MY 1523001 software version: 7.3.0.8799. Firm ware version: 3354 for analysis of mineral element. The infected leaf shows enhanced content in potassium, iron, manganese, copper, nickel, chromium, and aluminium element. On the Contrary, elements such as magnesium, sodium, calcium, lead, zinc, boron, strontium and thallium were reduced in their contents reflect a high metabolic activity during pathogenesis.

**Keywords:** *Cocculus hirsutus* (L), *OidiumSp.* ICP- OES- Agilent 5800ICP- OES FAQ'S, minerals.

## INTRODUCTION:

A tropical climbing shrub- *Cocculus hirsutus*(L) belong to Family. Menispermaceae widely growing in western ghat of Maharashtra State, commonly called Jaljamine/Jalyamine, and patalagarudi in Sanskrit. This plant prominently found in and around Kolhapur city. In India it is found in Maharashtra, Punjab, Karnataka, Tamil Nadu, Gujarat, Madhya Pradesh, and in some North Indian State. The plant is scandent twiners with oblong to ovate leaves, subcordate at the base with soft hairs on both surfaces. Flower unisexual with cymose inflorescence, fruits are drupes, seeds are curved, horse- shoe shaped with liguliformcotyledons. The plant has important medicinal properties, used in traditional system of medicine, in Ayurveda, roots are used to destroy kapha and vata, as laxative and having several properties. The plant possesses large number phytochemicals in leaves, stem and roots i.e., Syringaesinol, 1-3 Dibenzoisquinoline, isotrilobine, penduline, quercitol, trilobine, coclaurine, isotrilobine, magnoflorine, hirsutine, coclaurine, jantine-N-oxide, Hirsudiol, beta sitosterol etc. Hence it has antimalarial activity (Brahman P and Sunita 2018) antioxidant activity (Ameena *et al.*, 2022). Antihepatotoxic activity (Goodla L *et al.*, 2017), Antimicrobial- (Devi.K.Bet *et al.*, 2017), Antiviral (Shukla R.*et al.*, 2021). Anti-inflammatory (Senugottuvelu S, *et al.*, 2012), Anticancer (Thavamani B.S, *et al.*, 2014), wound-healing (Ranjan P.B *et al.*, 2009) Spermicidal (Varuna V and Lal., 2000). Cardiogenic (Satyanarayana K. *et al.*, 1994). Anti-Hyperglycemic(Badole S., *et al.*,2006). Spermatogenic activity (Sangameswaran and Jayaka., 2007).

Therefore, plant is most important in ayurveda and traditional healing, get affected by a fungus powdery mildew-*Oidium sp.* during autumn season and an attempt was made to study elements (mineral content) under infection.

#### **METHODS AND MATERIAL:**

*Cocculus hirsutus(L)* Die leaves affected with *Oidium sp.* fungus and healthy leaves were collected from Shivaji University, campus, Kolhapur during the month of November to December 2023. The harvested sample were brought to the laboratory (Department of Botany), washed with distilled water and blot to dry with filter paper. The sample were kept for sun drying for two days under shadow, later were kept in electric oven for a period of 1-2 consecutive days maintained a temperature 55-60°C. Soon after sample were powdered with the help of domestic grinder, to fine powder. The fine powder of healthy and infected leaves was subjected to digestion by tri-acid method prescribed by Toth *et al.*, (1948). The digested filtered sample were used for the estimation of minerals by Inductive Coupled Plasma Optical Emission Spectroscopy ICP-OES ( Agilent 5800 ICP-OES FAQ'S) using software version: 7.3.0.8799 and firm ware version: 3354. The results were expressed in ppm.

#### **RESULT AND DISCUSSION:**

The results were depicted in table 1, Fig A and B. The element calcium forms constituent of middle lamella and essential for reaction in fat metabolism, carbohydrate metabolism, nitrate metabolism and maintain permeability of plasma membrane. The element calcium get considerably consumed in the infected tissue of *Cocculus hirsutus(L)* table 1. An equivalent type of situation was recorded by Nagaraja (2001 and 2003) under pathogenesis. The utilization of calcium in fungi helpful for activating enzyme of Krebs's cycle as reported by Tsai *et al.* (1971) as well as Nitrogen metabolism (Lerer and Bar- Akiva, 1976). The sodium element not so significant for most of the plants, but involved in electric neutralization of organic and inorganic ions and control of membrane electrical potential and osmotic pressure, as a result sodium content might be consumed by the pathogen for its metabolism or sporulation (Brain and Hemming, 1950). A parallel report was recorded by Nagaraja (2008) in *Punica granatum* under pathogenesis.

The element potassium is responsible for translocation of organic solute and maintaining electro neutrality of the cell in plant and in fungi get raised in the infected leaves of *Cocculus hirsutus(L)* table 1. Increased amount of potassium content may be due to greater mobility and a tendency to accumulate at metabolically active site, or may be due to antagonistic effect and disturbed ratio of mineral elements, may cause accumulation as reported by Grumberg (1958) and Lal *et al.*, (1970). Much the same result was documented by Nagaraja (1994) under pathogenesis. The element iron acts as a catalyst and a component of ferredoxin, which plays in biological nitrogen fixation as well as electron transport system in plants and fungi get enhanced in the infected leaves of *Cocculus hirsutus(L)* table 1. Enhanced condition may be due to improper translocation to metabolically active site as reported by Brown (1976). A congenial finding was reported by Nagaraja (2001) in *Wood fordia sp.*, affected by infection. The element manganese acts as an activator of many enzyme such as nitrate reductase, hydroxylamine reductase and responsible for evolution of oxygen during photosynthesis, has a tremendous impact on fungal metabolism (Table.1 and Fig A & B). The manganese content get accumulated in the infected leaves of *Cocculus hirsutus(L)*. This indicates that pathogen may require in little quantity, a coincidental condition was recorded by Nagaraja (2008) and Ingavale *et al.*, (2020) under pathogenesis.

Element copper activates several enzyme system required for lignin synthesis, protein and carbohydrate metabolism reflect its essentiality, but under infection slight substantial accumulated condition was observed in *Cocculus hirsutus*(L)(Table1. Fig A & B) under pathogenesis.i.e. 0.03 ppm of cooper gets raise to 0.04 ppm under powdery mildew infection. Meanwhile, zinc micro element required for the formation of mitochondria and on an energy source as well as a metallic enzymes ( Riorden, 1976) get utilized by the fungus Table 1. A concurrent report was recorded by Nagaraja (2018) in Betel vine under pathogenesis. The element nickel forms a key component involved in nitrogen and biological nitrogen fixation and as an essential ultra-micronutrient (Marchner, 1993; Freyermuth et al., 2000), involved in several active enzymes in plants such as glyoxalases, peptide deformylases, methyl Co-M reductase and some superoxide dismutases. In *Cocculus hirsutus*, slight accumulation of nickel has been observed (Table 1. Fig. A & B) i.e. 0.01 ppm gets increased to 0.02 ppm in infected leaves. A commensurate finding was recorded by Nagaraja and Mohan (2018) in *phyllanthus ninuri* under pathogenesis.

The metal lead is not so much importance to plants, but it get absorbed in plants as well as in fungus for regulating pH, and other photochemical reactions, it get consumed in the infected leaves of *Cocculus hirsutes*L (Table1Fig A & B). A blooming report was published by Nagaraja (2003). The element magnesium essential for chlorophyll synthesis in plants and influenced over various enzyme and fermentation process. The present investigation shows, magnesium content get reduced in the infected leaves of *Cocculus hirsutus*(L) table-1 affected by powdery mildew disease. 3.24 ppm of magnesium content gets reduced to 3.06 ppm after infection. This indicates rapid translocation or pathogen may be utilized for its metabolism on reported by Padmanabhan

et al.,(1974). A parallel report published by Nagaraja (2005). Element boron, regulates carbohydrate metabolism, translocation of sugars mainly responsible for pollination and formation of fruits, it's importance was documented by Bowen and Gauch (1996), get consumed by pathogen in *Cocculus hirsutus* (L)affected by powdery mildew disease Table-1.

Even trace element aluminium and rare element such as strontium and thallium, get utilized by the pathogen in *Cocculus hirsutus*(L) die. Table 1, Fig. A & B..

Therefore, mineral forms vital role as well as part and parcel in the metabolism of plants and pathogen with their Integration alters plants physiognomy.

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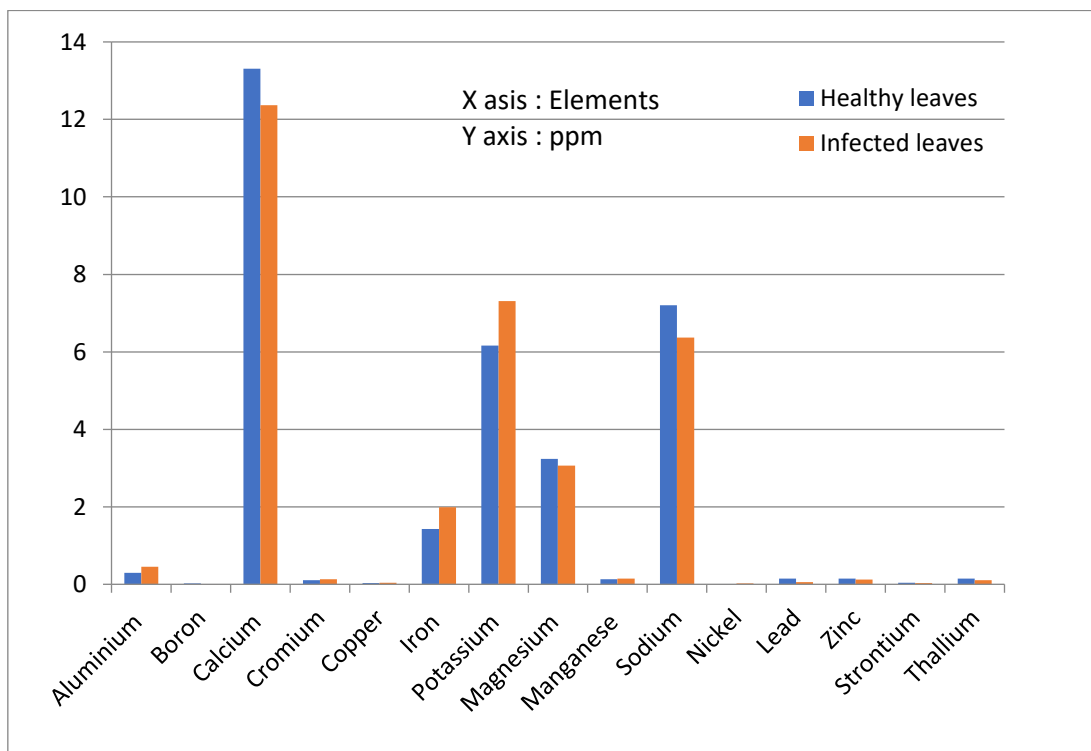
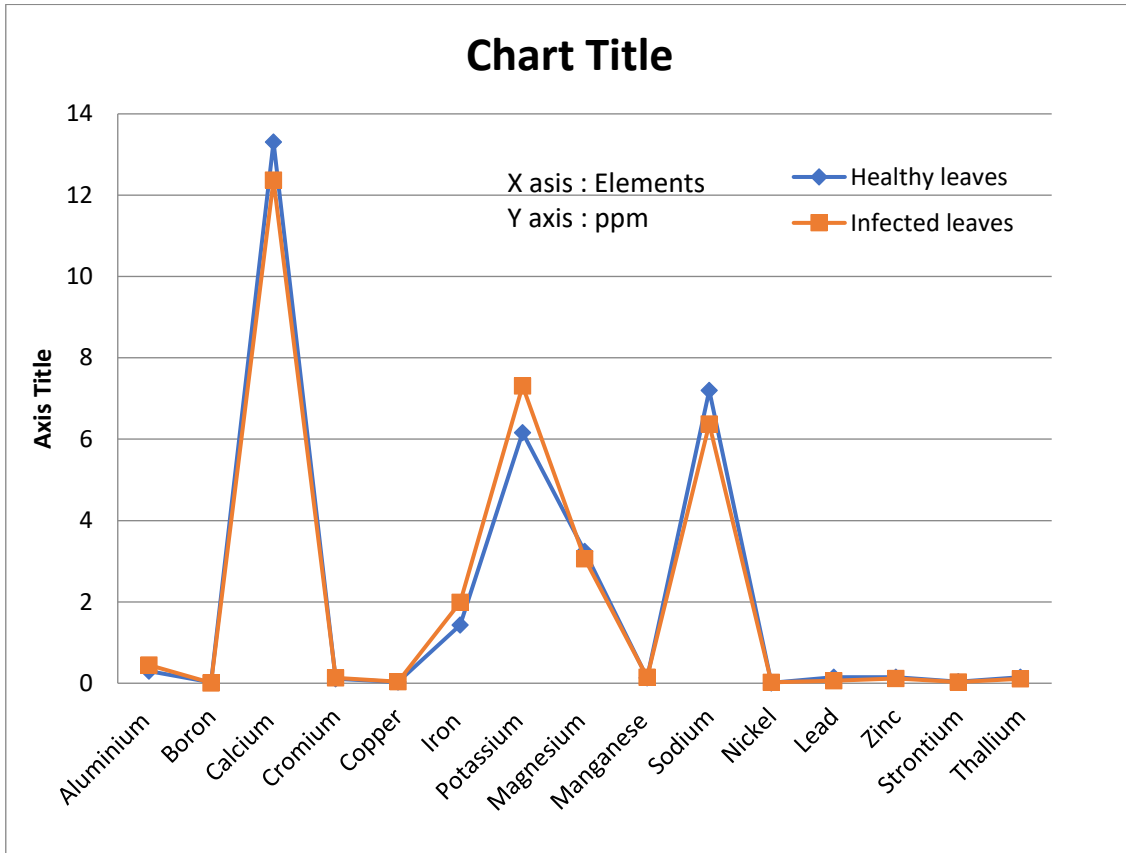
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**Table.1 Mineral nutrition in the leaves of *Cocculus hirsutus*(L) under pathogenesis.**

Sr.No.	Element *	Healthy leaves	Infected leaves
1.	Aluminium	0.30	0.45
2.	Boron	0.02	0.01
3.	Calcium	13.31	12.37
4.	Chromium	0.11	0.13
5.	Copper	0.03	0.04
6.	Iron	1.43	1.99
7.	Potassium	6.16	7.31
8.	Magnesium	3.24	3.06
9.	Manganese	0.13	0.15
10.	Sodium	7.20	6.37
11.	Nickel	0.01	0.02
12.	Lead	0.15	0.06
13.	Zinc	0.15	0.12
14.	Strontium	0.04	0.03
15.	Thallium	0.15	0.11

\*Expressed an ppm.



**Fig. A and B.**