



# INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

## “Aluminium uptake test in *Phyllanthus niruri* Linn. under Aluminium (Al) stress supplemented with Silicon (Si)”.

<sup>1</sup>Shweta Kumari and <sup>2</sup>Jyoti Kumar

<sup>1</sup>Research Scholar, <sup>2</sup>University Professor

Laboratory of Microbiology and Plant Pathology,

University Department of Botany,

Ranchi University, Ranchi, Jharkhand, India.

### ABSTRACT

Plants with medicinal properties are efficiently used not only today but also in ancient communities in prehistoric times. *Phyllanthus niruri* Linn. is a small medicinal herb belongs to Euphorbiaceae family having wide range of medicinal properties. And are used widely across the world for the treatment of various health issues like Jaundice, ulcers, skin diseases, diabetes, chest pain and urinary complications. In the present study experiments were conducted for analyzing Aluminium(Al) uptake in *Phyllanthus niruri* Linn under Al stress supplemented with Silicon(Si). The experimental setup was completely randomized with three treatments (0, 1.6 mmol/L Al, and 1.6 mmol/L Al + 2.0 mmol/L Si; being described as the control, Al toxicity and Al toxicity + Si, respectively). Treatments were given for two time intervals – 2hrs and 4hrs. The aluminium uptake was evaluated using Hematoxylin staining method. It was observed that Al uptake was same for both control and treated plants (Al toxicity and Al toxicity + Si) when the treatments were given for 2hrs. While on the other hand when the treatments were given for 4hrs there is an increase in Al uptake in treated plants (Al toxicity and Al toxicity + Si) as compared to control. But at the same it was also observed that the value for Al uptake in plants that were only treated with Al is higher than that were treated with solution containing Al along with Si. From this observation it can be concluded that Si is helpful in decreasing the effect of Al upto some extent.

**Index Terms - *Phyllanthus niruri* Linn., aluminium toxicity, silicon, aluminium uptake, hematoxylin.**

### I. INTRODUCTION

Medicinal plants play a vital role in Indian medicine and are used for the treatment of various diseases (Nisar, M. F., 2018). *Phyllanthus niruri* Linn. is a small medicinal herb belongs to Euphorbiaceae family having wide range of medicinal properties, used in the Indian ayurvedic systems from the ancient times (more than 2000 years) for the treatment of various health issues like Bronchitis, Anaemia, Leprosy, Asthma, Urinary disorders etc. (Narendra et al., 2012). Aluminium(Al) occupying nearly 40% of the world's arable lands act as the major environmental stress that limits productivity particularly at pH- 5.0 or below (Achary et al., 2008). Although Silicon(Si) has not been classified as an essential element it has been considered as beneficial element for the plants by improving the condition of soils and can lessen the toxic effects of Al as reported through various research works (Zhu et al., 2019; Malhotra et al., 2016). Concentration of toxic Al<sup>3+</sup> was found to decrease by the addition of silicon, presumably by the formation of Al-Si complexes, a non-toxic form (Ma, J. F., 2004). Based on this overview, our hypothesis is that Si must reduce the negative

impacts of Al in *Phyllanthus niruri* Linn. The aim of this research work is to determine aluminium uptake in *Phyllanthus niruri* Linn. under aluminium (Al) stress supplemented with silicon (Si) and determine if Si can improve the tolerance mechanism of *Phyllanthus niruri* Linn. exposed to Al toxicity.

## II. OBJECTIVE

Aluminium uptake test in *Phyllanthus niruri* Linn. under Aluminium (Al) stress supplemented with Silicon (Si).

## III. MATERIALS AND METHODS

Plants were collected from the Botanical Garden of Ranchi University, Ranchi. The experimental setup was completely randomized with three treatments (0, 1.6 mmol/L Al, and 1.6 mmol/L Al + 2.0 mmol/L Si; being described as the control, Al toxicity and Al toxicity + Si, respectively). Treatments were given for two different time intervals – 2hrs and 4hrs (Lima et al. 2016). Root uptake of Al was determined by hematoxylin staining assay (Ownby, 1993). Freshly harvested roots from both the treatments (2 hrs and 4 hrs) and control were taken and washed thoroughly in running tap water for 10 min and then stained with solution containing 0.2% hematoxylin and 0.02% KIO<sub>3</sub> for 15 min at room temperature. After staining the roots were washed in distilled water for 10 min. Root tips of approximately equal length were excised and soaked in 4ml of 1N HCl for 1 h. The absorbance of the resulting clear solution was measured at 490nm using a UV–Visible spectrophotometer (Figure:1).

## IV. RESULT

There is an increase in aluminium uptake of *Phyllanthus niruri* Linn. with increase in time duration in both the experimental conditions (Al toxicity, Al toxicity+Si) as compare to control. This result can be explained by the following table and column graph (Table: 1 and Figure: 2). For 2hrs duration the calculated value for aluminium uptake under control condition as well as for the treated plants (Al toxicity and Al toxicity + Si) is same i.e 0.06. On the other hand when the treatments were given for 4hrs duration the calculated value for aluminium uptake under control condition is 0.08 while for the treated plants - Al toxicity and Al toxicity + Si, this value is 0.16 and 0.1 respectively. This result of Al toxicity + Si treatment plants have shown significant lesser aluminium uptake as compared to plants that are exposed to Al toxicity.

## V. DISCUSSION AND CONCLUSION

The result reflects that the plants that were aluminium stressed shown higher aluminium uptake as compared to both control as well as the plants that were treated with aluminium along with silicon, presumably by the formation of Al-Si complexes. On the basis of above findings, it may be concluded that Si exhibits beneficial effects on plant *Phyllanthus niruri* Linn.

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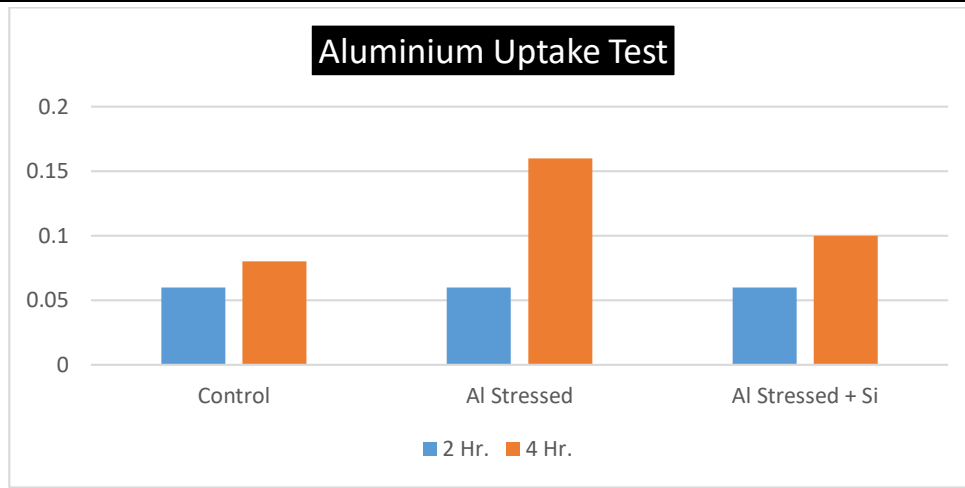
## FIGURES AND TABLE



**Figure 1:** Aluminium uptake test using hematoxylin stain method.

**Table 1:** Showing absorbance for aluminium uptake in *Phyllanthus niruri* Linn. in control as well as treated with Al Stress and Al Stress + Si.

Duration	Control	Al Stressed	Al Stressed + Si
2 Hr.	0.06	0.06	0.06
4 Hr.	0.08	0.16	0.1



**Figure 2:** Column graph showing comparative aluminium uptake in *Phyllanthus niruri* Linn. in control as well as treated with Al stress and Al stress + Si.

