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A study on physiological and biochemical characterization of selected radish plant

Shehnaz Kousar, Saba, Muhammad Zubair, Hamna Asif, Sana Ashraf, Abdul Karim, Sobia Tariq, Muhammad Imran Anwar*, Asia Arooj

Department of Botany, University of Agriculture, Faisalabad, Pakistan

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Abstract

Substantial metals are boss natural contaminations and their heightening poisonousness causes danger for biological and ecological reasons. Nickel as one of the significant hefty metal poisons is of impressive concern since its focus is quickly expanding in soils of various pieces of the world. Nickel is generally utilized in silver processing plants, amalgam, shades electroplating, zinc based projecting and capacity batteries. The aims of this study included the study of anatomy and biochemical characterization of radish plant under stress conditions. The objective of this paper is to summarize the overview of the sources, essentiality, uptake Ni toxicity in plants. To check the effect of Nickel sulphate on Radish, amounts(0, 50, 100, 150mM) on radish seedlings through Foliar medium, whole soil culture experiment was performed in the wire house of old Botanical Garden, University of Agriculture Faisalabad. Statistical analysis was achieved after collection of data by using appropriate computer software such as ANOVA. All morphological changes were observed to collect the data for the biochemical analysis. Nickel Sulphate act as suppressor that bring the reduction in growth as well as weight of fresh root (P≥0.001). Under controlled conditions maximum reduction was observed as compared at 150mM Nickel sulphate that was applied in Foliar medium. Nickel pollution is a serious environmental concern which led to research on phytoremediation.

***Corresponding Author:** Muhammad Imran Anwar ✉ muhammadimran0646292@gmail.com

Introduction

Radish with scientific name as the *Raphanus sativus* additionally called 'Daikon', is a significant vegetable root crop particularly in Asia. There is an enormous variety fit as a fiddle of roots from littler than 3cm in measurement on account of the European nursery radish to in excess of 30cm in breadth for 'Sakurajima Daikon' and from a round kind on account of the European nursery radish and 'Sakurajima Daikon' to a long sort, for example, 'Moriguchi Daikon' having a root in excess of 2m long. New fledglings are utilized as a vegetable, and in tropical Asia, juvenile siliques are expended as a vegetable. Radish is likewise delivered as an oil crop, oil being extricated from develop seeds. Radish roots contain glucosinolates, which are hydrolyzed by innate myrosinase after disturbance of cells, bringing about creation of impactful parts, for example isothiocyanates. Since 4-methylthio-3-butenyl isothiocyanate created from the major glucosinolate in radish has been accounted for to have hostile to, 2 and against carcinogenicity, 3 radish may turn out to be more well known for use in servings of mixed greens (Alexander *et al.*, 2006).

Radish has a place with a sort unique in relation to that of turnip (*Brassica rapa*), however they are profoundly comparative in morphology to one another as vegetables. Genome synthesis between these species are complicated, 6, 7 proposing that broad genome modifications have happened during or after speciation of these species, while in general genome synthesis are very much moderated in Poaceae crops, for example rice, wheat, maize, grain, and sorghum, 8 and Solanaceae crops, for example tomato, potato, and eggplant (Antoniadis *et al*., 2008).

Nickel, one of the significant hefty metal toxins is of extensive concern since its fixation is quickly expanding in soils of various pieces of the world. Nickel is generally utilized in silver processing plants, compound, shades electroplating, zinc based projecting and capacity batteries. The expanding convergence of Ni2+ has been appeared to restrain seed germination and seedling development of various plant species. Nickel is quickly taken up by the plant root framework and exploration with various plant species have indicated that Ni can hinder an enormous number of plant catalysts, for example, those of Calvin cycle and chlorophyll biosynthesis. The Reactive Oxygen Species (ROS) are delivered in the youthful sequencing leaf cells unreasonably under unpleasant conditions and are eliminated by complex non-compounds (ascorbate, glutathione, α-tocopherol) and chemicals (CAT, APX, GPX, SOD, GR and so forth) cancer prevention agent systems. Plants have advanced cancer prevention agent pathways that are generally adequate to shield them from oxidative harm during times of typical development and moderate pressure (Ashraf *et al.,* 2011).

The significant flagging systems working in metals worries notwithstanding the other natural burdens are calcium flagging, hormone flagging and MAPK flagging. Calcium flagging utilizes large number of calcium detecting proteins like Calmodulins (CaMs), CaM like proteins (CMLs), Calcineurin B-like proteins (CBLs), and Ca2+-subordinate protein kinases (CDPKs) that dilemma to Ca2+ and trigger distinctive downstream flagging pathways. In the event of hormone motioning there are diverse plant hormones that assume job in metal pressure reaction (Choudhari *et al.,* 1997).

Substantial metals are boss natural contaminations and their heightening poisonousness causes danger for biological and ecological reasons. The rule reason for the delayed nearness of weighty metals in the earth is their non-biodegradable nature. Nickel, one of the significant hefty metal poisons is of impressive concern since its focus is quickly expanding in soils of various pieces of the world. Nickel is the generally utilized in silver processing plants, amalgam, shades electroplating, zinc based projecting and capacity batteries. The expanding grouping of Ni2+ appeared to repress seed germination and seedling development of various plant species (Espen *et al*., 1997).

Different techniques for remediating metal dirtied soils exist; they extend from physical and concoction strategies to natural strategies. Generally physical and

compound techniques, (for example, exemplification, cementing, adjustment, electro kinetics, verification, fume extraction, and soil washing and flushing) are costly and don't make the dirt reasonable for plant development. Natural methodology then again supports the foundation/restoration of plants on dirtied soils. It is an earth benevolent methodology since it is accomplished by means of regular cycles. Bioremediation is additionally an efficient remediation procedure contrasted and other remediation strategies. This paper talks about the nature and properties of soils contaminated with weighty metals. Plant development and execution on these dirts were inspected. Natural methodologies utilized for the remediation of hefty metal contaminated soils were examined (Ghani *et al*., 2019).

The aims of this study included the study of anatomy and biochemical characterization of radish plant under stress conditions. Ni has negative effect on photosynthesis and respiration. High uptake of Ni induces a decline in water content of dicot and monocot plant species. The objective of this paper is to summarize the overview of the sources, essentiality, uptake Ni toxicity in plants. Nickel pollution is the serious environmental concern which led to research on phytoremediation.

Material and methods

Study Design

To check the effect of Nickel sulphate on the Radish, amounts (0, 50, 100, 150mM) on radish seedlings through Foliar medium, whole soil culture experiment was performed in the wire house of old Botanical Garden, University of Agriculture Faisalabad. In this study it was noticed that nickle sulphate act as suppressor on growth of the plant. Statistical analysis was achieved after collection of data by using appropriate computer software such as ANOVA. All morphological changes were observed to collect the data for the biochemical analysis. To check the activity of nickel on on radish seedlings, an experiment was carried out in jar by applying the nickle in the solution form by using Foliar application in various concentration ranging from 0-30mM to the early seedling afterward 2 weeks of germination.

Sowing and Culture Medium

Plastic pots with underneath hole filled with 2.5kg of Sand were used for directly sowing of seeds of radish genotype Mooli Day-40 that were purchased from Ayyub Agriculture Research Institute (AARI) Faisalabad and then these pots were covered by cotton cloth. Before starting of my experiment, I waited for germination of seedlings by maintaining the 5 plants per pot of equal size through thinning and then, I applied Nickle to check its effect.

Treatments and Source

To make the one litter solution of nickle sulphate, simple water taken from the filler plants present in the University of Agriculture, Faisalabad and nickle sulphate was taken from botany department. Then the solution was applied to the plants. 1- Normal water or 0mMNickel solution 40-50mMNickel solution 80-100mM Nickelsolution 130-150mM Nickel solution.

Root and Shoot Determination

To evaluate the amount of root and shoot was used. 0.10g of leaf samples were collected through cutting and socked them into a beaker containing 10ml of 80% acetone then these sample were centrifuged after 24 hours at 10,000rpm for 5min and then spectrophotometer was used to check the supernatant's absorbance 480, 645 and 663nm (Hitachi-U2001, Tokyo, Japan (Ghani *et al*., 2019)

Statistical analysis

For statistical analysis of collected data, I applied CO-state and draw the Anova tables, through filling of tables (Van *et al*., 2019).

Results and discussion

Root fresh weight (g)

The results was shown in table 1 that effect of nickel was observed in radish plant. The analysis of collected data from fresh weight of radish's roots that were grown under controlled conditions is presented in table. Nickel Sulphate act as suppressor that bring the reduction in growth as well as weight of fresh root ($P \geq 0.001$). Under controlled conditions maximum reduction was observed as compared at 150mM Nickel sulphate that was applied in Foliar medium.

Root dry weight (g)

The root dry parameter was shown in table 1 that effect of nickel was observed in radish plant. The analysis of collected data from dried weight of radish's roots that were grown under controlled conditions is presented in table. Nickle sulphate act as suppressor that bring the reduction in growth as well as weight of dried root (P≥0.001). Under controlled conditions maximum reduction was observed as compared at 150mM Nickel Sulphate that was applied in Foliar medium.

Table 1. Shows the root length, shoot length, root weight and shoot weight.

Pots	Root Length	Shoot Length	Root Weight	Shoot Weight	No. of leaves
T1	17cm	18cm	11.9g	36.6g	12
T2	13cm	15cm	4.6g	19.2g	11
T3	21cm	18cm	6.48g	18.1g	12
T1	21cm	17cm	17.2g	38.4g	15
T2	21cm	20cm	21.47g	58.3g	17
T3	20cm	15cm	8.70g	12.4g	12
T1	17cm	13cm	4.92g	7.7g	09
T2	25cm	17cm	15.73g	54.3g	18
T3	23cm	17cm	15.16g	36.9g	14
T1	13cm	19cm	8.42g	23.9g	14
T2	18cm	15cm	9.16g	36.3	13
T3	20cm	15cm	17.30g	29.5	12

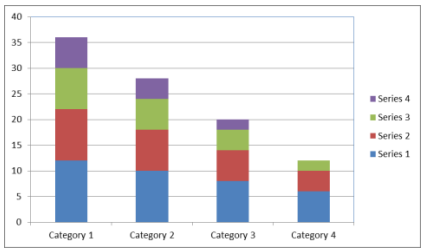
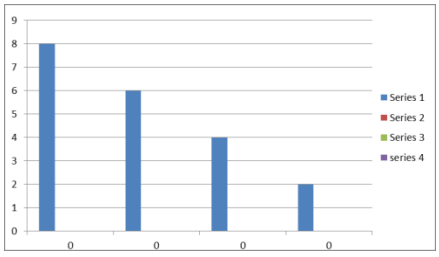


Fig. 1. Influence of exogenously applied nickel sulphate on Root fresh weight of radish genotype grown under control and Nickel sulphate effect conditions.



Treatment 0mM Treatment 50mM Treatment 100mM Treatment 150mM

Fig. 2. Influence of exogenously applied nickel sulphate on Root dry weight of Radish genotype grown under control and nickel sulphate effected conditions.

The analysis of collected data from radish's root length that were grown under controlled conditions is presented in table. Nickle sulphate act as suppressor that bring the reduction in growth as well as root length (P≥0.001). Under controlled conditions maximum reduction was observed as compared at 150mM Nickel sulphate that was applied in Foliar medium (Naeem *et al.*, 2019).

The analysis of collected data from radish's shoot length that were grown under controlled conditions is presented in table. Nickle sulphate act as suppressor that bring the reduction in growth as well as shoot length (P≥0.001). Under controlled conditions maximum reduction was observed as compared at 30mM Nickel sulphate that was applied in foliar medium (Li *et al.*, 2019).

Heavy metals are major environmental pollutants when they present in high concentration in soil and have toxic effects on growth and development of plants. Industrial activities result in heavy metal pollution of large areas of land, which greatly affects natural vegetation. plants were grown in soil supplemented with Nickel sulphate (Ni So4) concentrations (50,100 and 500mg/Kg of soil) Plant growth was also decreased as concentration of metals was increased as compared to control plants. Photosynthetic pigments and protein content decreased as concentration of metals was increased in comparison of control plants. Activity of antioxidative enzymes as guaiacol peroxidase and superoxide dismutase and Catalase was increased while ascorbate peroxidase activity decreased with increasing concentration of heavy metals (Meng *et al.*, 2019).

The heavy metals that are available for plant uptake are those that are present as soluble components in the soil solution or those that are easily solubilized by root exudates. Although plants require certain heavy metals for their growth and upkeep, excessive amounts of these metals can become toxic to plants. The ability of plants to accumulate essential metals equally enables them to acquire other nonessential metals.

As metals cannot be broken down, when concentrations within the plant exceed optimal levels, they adversely affect the plant both directly and indirectly (Espen *et al.*, 1997).

Some of the direct toxic effects caused by high metal concentration include inhibition of cytoplasmic enzymes and damage to cell structures due to oxidative stress. An example of indirect toxic effect is the replacement of essential nutrients at cation exchange sites of plants. Further, the negative influence heavy metals have on the growth and activities of soil microorganisms may also indirectly affect the growth of plants. For instance, a reduction in the number of beneficial soil microorganisms due to high metal concentration may lead to decrease in organic matter decomposition leading to a decline in soil nutrients. Enzyme activities useful for plant metabolism may also be hampered due to heavy metal interference with activities of soil microorganisms (Ashraf *et al.,* 2011)

Conclusion

The amount of nickle sulphate given during experiment was applied to radish plant. In this study it was noticed that nickle sulphate act as suppressor on growth of the plant. The statistical analyses by using ANOVA also showed the significance and non-significance in the traits of radish plants. In all this study Moli Days-40 showed the satisfying results in control and showed lower result in 30mM Nickel sulphate concentration. This study helpful to understand the mechanism of toxicity in plants

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