Effect of Nickel on Different Physiological Parameters of Raphanus Sativus

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Abstract- To check the activity of nickel sulphate (0, 10, 20 and 30 mM) 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 and it also decreased the content of carotenoids and chlorophyll contents (Chlorophyll-a, b). 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. A marked reduction in chlorophyll a and chlorophyll b was noticed with slight elevation of carotenoid.

I. INTRODUCTION

Radish (*Raphanus sativus* L.) belongs to genus Raphanus, family Cruciferae that is mostly found in the central and south Asia (Thamburaj and Singh, 2005). Epidermis outer covering protects plants againt stress (Raza *et al*., 2019). Being the cheapest source of natural protective minerals, the consumption of vegetables plays protective role against various diseases. The per day consumption of vegetables decided by dietitians is 300 g that includes 125 g of green leafy vegetables, 175 g of roots and other vegetables and its recommended availability should be 145 g per day (Salaria, 2009). Nutraceuticals obtained from plants have basic health benefits (Usman et al., 2019).

Radish has spicy taste as well as have anti-cancer activity due to presence of rich amount of chemical substances such as myrosinase, glucosinolate, and isothiocyanate. Some varieties of plants designed for experimental determination of molecular studies (Ahmad et al., 2019, Ahsan et al., 2019). A variety of plants products used for herbal treatments(Naeem et al.,2019). A selective study was done in Germany in 2009 in which 11,405 male participated that showed the relation between nutritional intake of glucosinolate and the high risk of prostate cancer (Steinbrecher *et al.,* 2009). Apoptosis of cancer cells in human lung is mediated by *4*-Methylsulfinyl-3-butenyl isothiocyanate that is present in radish (Wang *et al.,* 2014).Some of the plants contained materials that identify as DNA barcodes (Naeem *et al*., 2019).

Recently a study has revealed that sulforaphane (isothiocyanate)that is present in radish, has inhibitory role against proliferation ofcancer cells in breast(*Pawlik et al.,* 2017). A variety of climate and soil conditions and suitable nutritional amount and agro-techniques have great effect on the optimum growth and production of radish.Cadmium toxicity may affect various parts of plants (Shafiq et al., 2019).Soil fertility and various agro-climatic conditions mostly depends on nutritional requirement. Plants have opening called stomata and epidermis is the outer layer of cells(Naeem *et al*., 2019). The root of radish has rapid growth rate at very short duration of time. The optimum growth of radish can easily be achieved by adding essential organic and inorganic fertilizers(Dhanajaya, 2007). Different herbs are used for medical purposes (Usman *et al*., 2019).

II. MATERIALS AND METHODS

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 2.5 kg 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.

3.2. Treatments and Source:

To make the one litter solution of nickle sulphate, I usedsimple 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 *0mM*Nickel solution
2- *10mM*Nickel solution
3- *20mM*Nickelsolution
4-*30mM*Nickel solution

3.3. Harvests:

Before harvesting, plants were treated with solution for 45 days by following the parameters.

Photosynthetic pigments:

To evaluate the amount of carotenoids and chlorophyll a and b, methodology of Arnon (1949) 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 10,000 rpm for 5min and then spectrophotometer was used to check the supernatant's absorbance 480, 645 and 663 nm(Hitachi-U2001, Tokyo, Japan).

Statistical Analysis :

For statistical analysis of collected data, I applied CO-state and draw the Anova tables, through filling of tables.

III. RESULTS AND DISCUSSION

Root fresh weight (g)

The analysis of collected data from fresh weight of radish's roots that were grown under controlled conditions is presented in table (Table 4.4, Fig 4.4). Nickle 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 30m*M* Nickel sulphate that was applied in Foliar medium (Fig 4.4).

Root dry weight (g)

The analysis of collected data from dried weight of radish's roots that were grown under controlled conditions is presented in table (Table 4.4, Fig 4..5). 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 30m*M* Nickel sulphate that was applied in Foliar medium (Fig 4.5).

Chlorophyll *a* (mg/g fresh weight)

The analysis of collected data from radish's chlorophyll *a* that were grown under controlled conditions is presented in table (Table 4.4, Fig 4.6). Nickle sulphate act as suppressor that bring the reduction in growth as well as chlorophyll *a*(P≥0.001). Under controlled conditions maximum reduction was observed as compared at 30m*M* Nickel sulphate that was applied in Foliar medium (Fig 4.6).

Chlorophyll *b* (mg/g fresh weight)

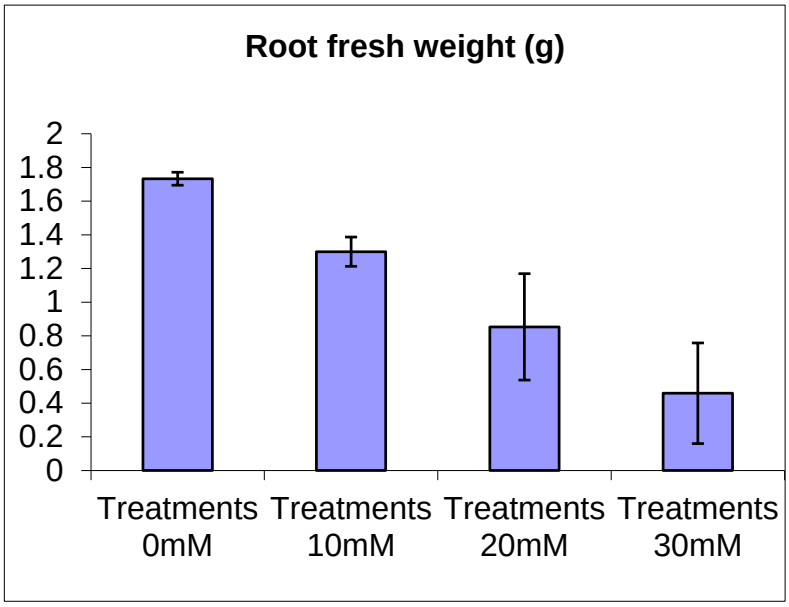
The analysis of collected data from radish's chlorophyll *b* that were grown under controlled conditions is presented in table (Table 4.4, Fig 4.7). Nickle sulphate act as suppressor that bring the reduction in growth as well as chlorophyll*b* (P≥0.001). Under controlled conditions maximum reduction was observed as compared at 30m*M* Nickel sulphate that was applied in Foliar medium (Fig 4.7).

Table.4.4: Analysis of Variance of data for root fresh weight of radish (Moli Day-40) under Nickel sulphate effect

SOV	Df	SS	MS	F	P
Treatment	3	2.806	0.935	5.506	.0240*
Error	8	1.359	0.169		

***, **, * = significant at 0.001, 0.01 and 0.05 probability levels respectively, ns= non- significant

Fig 4.4: Influence of exogenously applied nickel sulphate on Root fresh weight of radish genotype grown under control and Nickel sulphate effect conditions



SOV	Df	SS	MS	F	P
Treatment	3	6.338	2.112	34.771	.0001***
Error	8	4.860	6.075		

***, **, * = significant at 0.001, 0.01 and 0.05 probability levels respectively, ns= non- significant

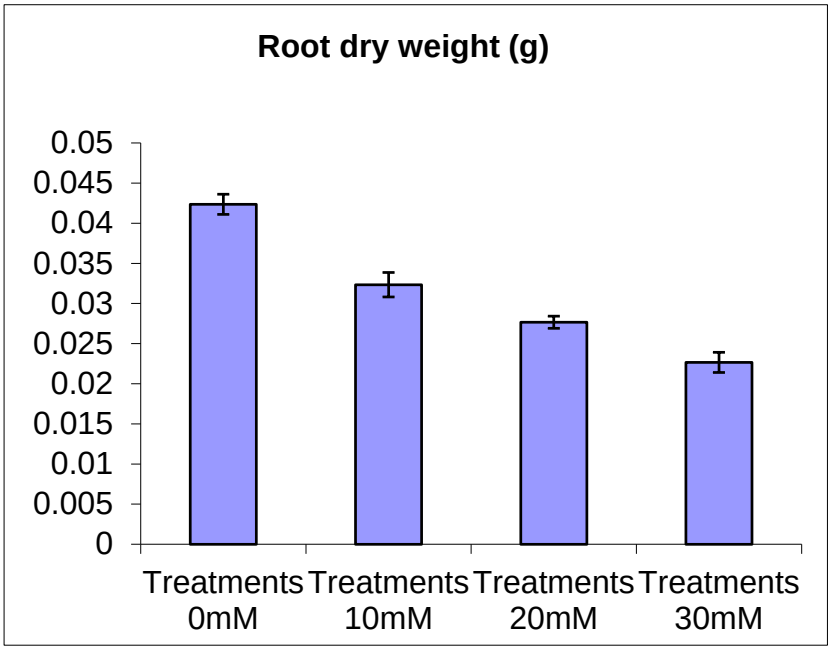


Fig 4.5: Influence of exogenously applied Nickel sulphate on Root dry weight of radish genotype grown under control and nickel effect conditions.

Fig 4.6: Analysis of Variance of data for chlorophyll a of radish(Moli Day-40) under Nickel sulphate effect.

SOV	Df	SS	MS	F	P
Treatment	3	0.175	0.058	54.874	.735*
Error	8	0.009	0.001		

***, **, * = significant at 0.001, 0.01 and 0.05 probability levels respectively, ns= non- significant

Fig 4.6: Influence of exogenously applied nickel sulphate on Chlorophyll *a* of radish genotype grown under control and nickel sulphate effect conditions.

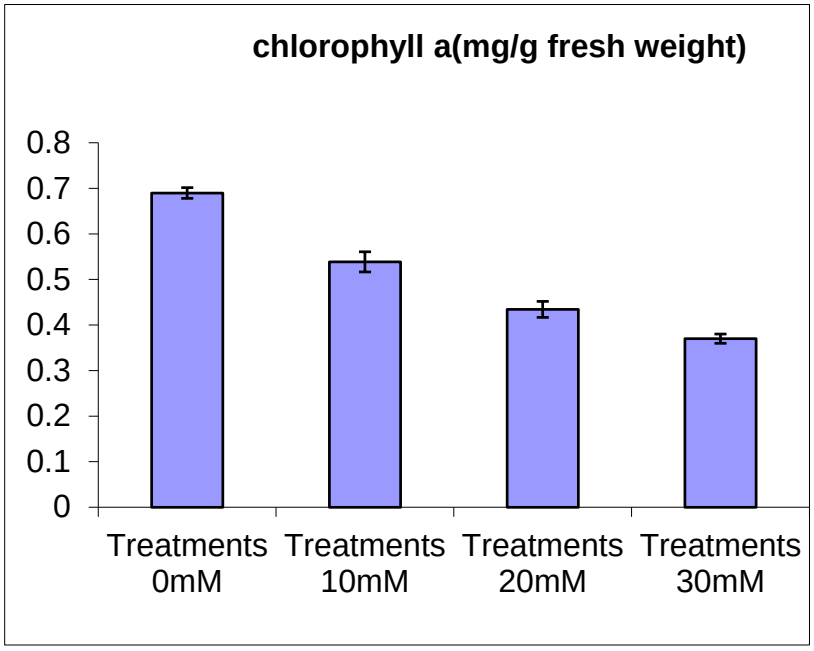


Fig 4.7: Analysis of Variance of data for chlorophyll b of radish (Moli Day-40) under Nickel sulphate effect

SOV	Df	SS	MS	F	P
Treatment	3	1.721	0.573	45.120	.993*
Error	8	0.102	0.012		

***, **, * = significant at 0.001, 0.01 and 0.05 probability levels respectively, ns= non- significant

IV. CONCLUSION

To check the activity of nickle sulphate (0, 10, 20 and 30 m*M*)on radish seedlings through Foliar medium, whole soil culture experiment was performed in the wire house of old Botanical Garden, University of Agriculture Faisalabad(*Raphanus sativus*). The amount of nickle sulphate given during experiment were as 0 m*M* Nickel sulphate +1liter H2O, 10mM Nickle sulphate +1liter H2O, 20 m*M* Nickel sulphate+1liter H2O and 30 m*M* Nickel sulphate+1liter H2O. Consistentamount of nickelwas applied. In this study it was noticed that nickle sulphate act as suppressor on growth of the plant and it also decreased the content of carotenoids andchlorophyll contents (Chlorophyll-a, b). Moreover, the Imposition of nickel sulphatealso cause the accumulation of carotenoids in plants. 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 30 m*M*Nickel sulphate concentration.

REFERENCES

[1] A Raza, Iqra , U. Ghani , N. Azhar, I. Hussain, M. U. Khan, S. Bano, A. Rubab, S. N. Sajid, S. A. H. Bukhari, Z. Haider, M. Mubeen, S. A. Sajid, J. Ali, N. Aish, A. Wahab.(2019). Characterization of Selected Plants Leaves with Particular Emphasizes on Epidermis. Haya Saudi Journal of Life Sciences,4(9): 326-330

[2] Ahmad I, Khan S, Naeem M, Hayat M, Azmi UR, Ahmed S, Murtaza G, and Irfan M.(2019). Molecular Identification of Ten Palm Species using DNA Fingerprinting. International Journal of Pure & Applied Bioscience, 7(1): 46-51.

[3] Ahsan M, Aslam M , Akhtar MA , Azmi UR, Naeem M, Murtaza G, Irfan M, Shafiq S.(2019). Effect of inoculation of three rhizobial strains on maize hybrids. Journal of Biodiversity and Environmental Sciences,14(6), 168-177.

[4] Dhananjaya,J. 2007. Organic Studies in Radish (Raphanus sativus L.) Varieties. Dharwad Uni. Agri. Sci., 580:12-13.

[5] Ghani U, Bukhari SSH, Ullah S, Rafeeq H, Saeed MM, Amjad A, Hussain M, Akmal A, Zahra FT, Qasim F, Taufiq T, Chand SC.(2019). A review on Nutraceuticals as a Therapeutic Agents. International Journal of Biosciences. 15(5), 326-340

[6] Muhammad Naeem,,et al.(2019).Principles of Biochemistry and Biological Sciences. Nish tar Publications(Pvt).Ltd.pp.138

[7] Naeem M ,Hayat M, Qamar SA, Mehmood T, Munir A, Ahmad G, Azmi UR, Faryad MA, Talib MZ, Irfan M, Hussain A, Hayder MA, Ghani U, Mehmood F.(2019).Risk factors, genetic mutations and prevention of breast cancer. International Journal of Biosciences, 14(4), 492-496.

[8] Naeem M, Hussain A, Azmi UR, Maqsood S, Imtiaz U, Ali H, Rehman SU, Kaleemullah, Munir HM, Ghani U.(2019). Comparative Anatomical Studies of Epidermis with Different Stomatal Patterns in Some Selected Plants Using Compound Light Microscopy. International Journal of Scientific and Research Publications ,9(10):375-380

[9] Naeem M,Ali J,Hassan MZ,Arshad B,Rao MHI,Sarmad MSK,Irfan U,Khan NA,Sohail MS,Umar M, Hassan MU(2019).Novel Approach Towards DNA Barcoding as a Tool in Molecular Biologyand Biological Activities of Cyclotides with Particular Emphasizes at Molecular Level. Biological Forum-An InternationalJournal,11(2):83-96.

[10] Pawlik, A., M. Wała, A. Hać, A. Felczykowska and A. Herman-Antosiewicz. 2017. Sulforaphene, an isothiocyanate present in radish plants, inhibits proliferation of human breast cancer cells. Phyto. Med., 29:1-10.

[11] Salaria, A. S. and B. S. Salaria. 2009. Horticulture at a Glance. Jain Bro. New DL., 2:7-8.

[12] Shafiq S, Adeel M, Raza H, Iqbal R, Ahmad Z, Naeem M, Sheraz M, Ahmed U and Azmi UR.(2019).Effects of Foliar Application of Selenium in Maize (Zea MaysL.) under Cadmium Toxicity. Biological Forum-An International Journal,11(2): 27-37.

[13] Steinbrecher, A., K. Nimptsch, A. Hüsing, S. Rohrmann and J. Linseisen. 2009. Dietary glucosinolate intake and risk of prostate cancer in the EPIC-Heidelberg cohort study. Int. J. Cancer. 125:2179-218.

[14] Thamburaj, S. and N. Singh. 2005. Vegetables, tuber crops and spices. Ind. Coun. Agri. Res., 40:468-470.

[15] Usman G, Ammara B, Hamza R, Muhammad N, Syed S.H.B, Hafiz A, Amna N, Sara,S, Shahid, AC.(2019).Saudi Advancement and Future Directions towards Herbal Treatment for Various Diseases. Saudi Journal of Medical and Pharmaceutical Sciences, 5(11): 931-941

[16] Usman G, Muhammad N, Hamza R, Usman I, Ayesha A, Saqib U, Asim R, Fatima Q.(2019). A Novel Approach towards Nutraceuticals and Biomedical Applications. Scholars International Journal of Biochemistry , 2(10): 245-252

[17] Wang, N., W. Wang, P. Huo, C. Q. Liu, J. C. Jin and L. Q. Shen. 2014. Mitochondria-mediated apoptosis in human lung cancer a549 cells by 4-methylsulfinyl-3-butenyl isothiocyanate from radish seeds. Asian Pac. J. Cancer Prev., 15:2133-2139.

[18] Wang, S. H., Z. M. Yang, H. Yang, B. Lu, S. Q. Li. And Y. P. Lu. 2004. Copper-induced stress and antioxidative responses in roots of Brassica juncea L. Bot. Bulle. Academ. Sin., 45:203-212.

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