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Biological Effects and Potential Role of Biological Techniques in Reduction of Growth Factors Owing to Metals Toxicity

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Abstract

The radish is also cultivated for oil purposes, as the oil is being take out from its seeds. The characteristics and the economic importance of radish vary among the East & West of world. Radish has the anti-diabetic, anti-turmeric and the anti-mutagenic properties. Different metals affected the radish plant by reducing the growth factors. There is need to control the level of toxic metals accumulation in radish. Ni is extensively utilized in the silver plants, alloy, zinc casting, storage batteries and in pigment electroplating. The growing Ni $^{2+}$ concentration has been investigated and it inhibits germination of seed and growth of seedlings in many plants. In normal rats *R. sativus* rises the HDL of serum. Some radish varieties designated for the experimental purpose of molecular investigations. Bioremediation is an inexpensive remediation method as compared to others remediation methods. Next generation sequencing technology provides a new technique both for the transcriptome analyses and genes mapping.

Keywords: Biological effects, toxic metals, radish plant, bioremediation, transcription.

INTRODUCTION

The big variation is present in the size of root and root shape, the minimum of diameter is 3cm present in European-garden-radish and the maximum of 30cm diameter in "Sakurajima Daikon" and in round form in European garden radish and 'Sakurajima Daikon' to a long form like in "Moriguchi Daikon" with 2m root length. Fresh shoots are utilized as vegetable, and the young siliques are used as vegetable in the tropical Asia [1]. The radish is also cultivated for oil purposes, as the oil is being take out from its seeds. The glucosinolates are present in radish that are hydrolysed by the in-built myrosinase after the cells disruption, causes the pungent components production. It is a prominent roots vegetable crop that is cultivated in tropical to temperate regions. Leaves and roots are enriched with mineral, vitamin A, vitamin C, and the carbohydrates [2, 3].

Radish and turnip (*Brassica rapa*) belongs to a different genus, but morphologically both are very similar as they are consumed as vegetable. Siliques shape and size of seed is different in both of them. Phylogenetic analysis of Brassicaceae family species using the DNA indicators or genes sequences of nucleotide have shown that the *R. sativus* fits *rapa* or *oleracea* pedigree not to *nigra* line. These species also have the different number of chromosomes i.e. in *B. nigra* n=8, in *B. oleracea* n=9 and in *B. rapa* n=10 [4]. The characteristics and the economic importance of radish vary among the East & West of world. In the Easter region of the world, the radish plants have the various shapes and the large roots and it is known as 'Asian big radish' and are cultivated for oil seeds or immature pods production, while in the west the radish has small vegetable. The large radish of Asia is

estimated to become eventually popular in Western regions of the world. Radish belongs to genus *Raphanus*, and due the pod and seeds shape it similar to *Brassica* species [5].

Table-1: Shows the composition of radish plant with medicinal importance

Chemical Compounds	Medicinal importance	Reference
Carotenoids	Cancer	[6]
Chlorophylls	Cardiovascular	[7]
Vitamins	Cancer, heart, liver cancer	[8]
Minerals	Diabetes, kidney functions	[9]
Other compounds	Heart, vascular functions	[10]

Biological Activities of Radish

Radish has the anti-diabetic, anti-turmeric and the anti-mutagenic properties. In normal rats *R. sativus* rises the HDL of serum. In rats with higher fat diet, the *R. sativus* extract repairs the epithelium and rises enterocytes [11]. In Bangladesh, radish is produced in large quantity about 200840 tons. On the other hand, its root vegetable medicinal importance are still unknown in the Bangladesh. We reflect that the extract of hot water rather than the extract of methanol or ethanol would relevantly imitate the actual effects of ingestion of *R. sativus* it confirms its root true medicinal values [12].

Fig-1: Shows the morphology of radish plant

Due to the presence of glucosinolate, isothiocyanate and myrosinase radish have anti-cancer activities and also has spicy taste. Some radish varieties designated for the experimental purpose of molecular investigations. In Germany a selected investigation was done in 2009, in this study 11405 male contributed that revealed the relationship among nutritious consumption of glucosinolate and higher risk of prostate cancer [13].

Influence of metals on growth factors

The main reason of prolonged existence of heavy-metals in environment is due to the non-biodegradable nature of these metals. Ni, is one of the main heavy-metal pollutant and its concentration in the soil is increasing rapidly in different regions of the world. Ni is extensively utilized in the silver plants, alloy, zinc casting, storage batteries and in pigment electroplating. The growing Ni^{2+} concentration has been investigated and it inhibits germination of seed and growth of seedlings in many plants. Ni is quickly taken up by the roots of plant and the investigation of different plants have presented that the Nickle is capable to constrain a large numbers of enzymes in plants like the enzymes of chlorophyll biosynthesis and Calvin cycle [14-16].

Heavy-metals are needed only in very low quantity for sustaining the life, whereas the presence of large amount of these heavy-metals damage the cellular mechanism. Heavy-metals which effects the growth of many are organisms are Cu (copper), Al (aluminum) Fe (Iron), arsenate (As^{V}), Cr (chromium), Cd (cadmium), Pb (lead), Hg (mercury) etc. These heavy-metals have not effects only the plants but also the animal's kingdom. Their harmful impact on the agriculture has also been documented very well. At the cellular-level higher quantity of these metals damaged the many of the mechanisms. The most common mechanism is generation of ROS (reactive oxygen species) inducing the oxidative stresses, whereas others are the biomolecules inactivation through the essential metals ions displacement or by blocking the vital functioning groups [17, 18].

The main signaling system working in the metal stresses in adding to other environment stresses are the hormone signaling, calcium signaling and MAPK-signaling. The calcium signaling services assembly of calcium detecting proteins such as CaM, Calmodulins like proteins. CBLs (Calcineurin B-like proteins), and CDPKs (Ca^{2+}-dependent protein kinases) that bind to the Ca^{2+} ions and activate the different down-stream indicating pathways. In hormone-signaling the different hormones of plants which plays vital role in the metal stresses responses. Heavy-metals are the main pollutants of the environment and the rising toxicity of these metals causes danger for environmental and ecological reasons. The major cause of continued presence of these metals in environment is due to their non-biodegradable nature [19, 20].

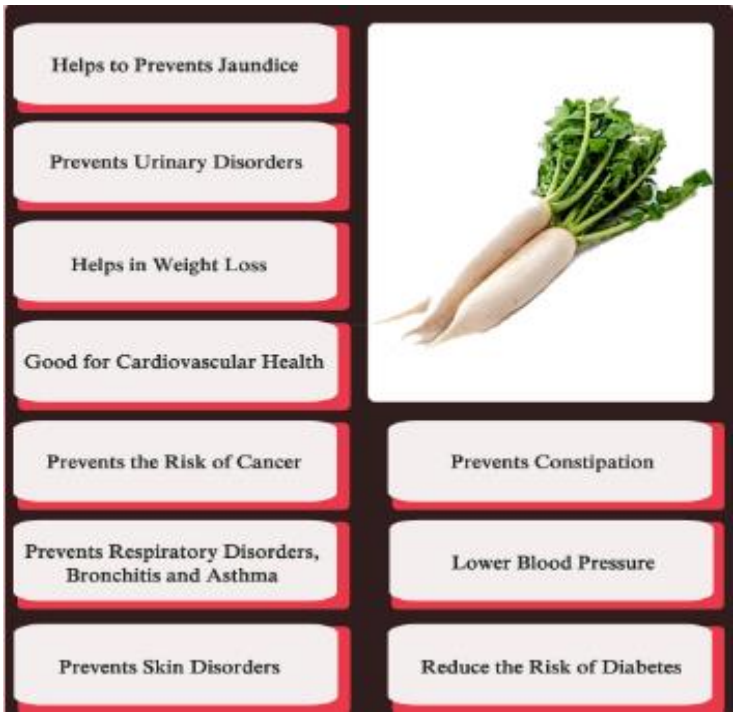

Fig-2: Shows the medicinal importance of radish plant

Biological and Chemical Effects of Toxic Metals

Naturally the heavy-metals are present in soil, anthropogenic and geologic activities rise the amount of these metals which are destructive to both animals and plants [21]. These activities including the fossil fuel burning, smelting and mining of metals, pesticides and fertilizers use in the agriculture, batteries production and the others metal products in the industries, manure mud, and waste from municipal. Reduction of growth due to modifications in the biochemical and physiological procedures in the plants which grow on these metals contaminated soil has been noted. Continuous reduction in the growth of plant also decreases the yield of plant which finally leads to the insecurity of food. So, the remediation of this metal contaminated soil cannot be over accentuated [22].

Techniques to reduce heavy metals absorption

Many of the techniques of remediating heavy-metal contaminated soil exists; these techniques ranged from chemical and physical techniques to biological techniques [23]. Most chemical and physical techniques (like solidification, encapsulation, electrokinetics, vapour extraction, stabilization, nitrification and the soil flushing and washing) are costly and not make soil appropriate for the growth of plant. The bioremediation (biological approach) on other hand inspires the establishment or reestablishment of plant on the contaminated soil. It is considered as environment friendly technique because it is attained through the natural procedures. Bioremediation is an inexpensive remediation method as compared to others remediation methods. Biological methods used for the remediation of these metals contaminated soil were correspondingly emphasized [24-26].

Hence, there is a serious need to investigate more data on transcriptome of *R. sativus* tissues, which will assist their prospective utilization as a common reference for the other interconnected *R. sativus* investigations. It was also testified that Radish has also been utilized as a medical plant due to its excellent pharmaceutical importance. For example, the roots of R. sativus have many peroxidases, which is used for medical purposes. With the progress of next generation technology of sequencing, hereditary data of radish was progressively shown in sreport [25-29].

Next generation sequencing technology provides a new technique both for the transcriptome analyses and genes mapping. RNA sequence is not reliant on previous info of genomic sequence of targeted species, which has been extensively applied for the transcriptomic related investigations in several *Brassicaceae* family species of plant. The *de novo* assemblage of sequencing reads is an important pace to attain genomic information's, like discovery of new genes, TF (transcription factor) discovery, mining of SSR (Simple Sequence Repeat) and gene expression outline analyses [30-32].

CONCLUSION

Different metals affected the radish plant by reducing the growth factors. There is need to control the level of toxic metals accumulation in radish. Hence, it helpful about the piece information of transcription factor families comprising of potentially transcription factors potentially recognized after completion of *A. thaliana* genomic sequencing.

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