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SEMINAR PRESENTATION
PLANT DEFENSE MECHANISM

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Introduction

- Unprecedented bioaccumulation and biomagnification of heavy metals (HMs) in the environment have become a dilemma for all living organisms including plants (Živković *et al.*, 2012).
- HMs at toxic levels have the capability to interact with several vital cellular biomolecules
- such as nuclear proteins and DNA (Liu *et al.,* 2014),
- leading to excessive augmentation of reactive oxygen species (ROS).

Introduction cont'd

- This would inflict serious morphological, metabolic, and physiological anomalies in plants
- Some of which includes:
  - chlorosis of shoot
  - lipid peroxidation and
  - protein degradation.

Introduction cont'd

- In response, plants are equipped with a repertoire of mechanisms to counteract HM toxicity.
- The key elements of these are chelating metals by forming phytochelatins (PCs) or metallothioneins (MTs) metal complex at the intra- and intercellular level (Mossor-Pietraszewska 2001; Rout *et al.,* 2001),
- This is followed with the removal of HM ions from sensitive sites or
- vacuolar sequestration of ligand-metal complex.

Plant Strategies to HM

- This can be summarized into three (3) basic strategies plant employs in dealing with metal intoxication. They are
  - Avoidance
  - Tolerance
  - Activation of antioxidant

Avoidance

- The first step towards dealing with metal intoxication is by avoidance strategy.
- This preclude the onset of stress via restricting metal uptake from soil or
- excluding it to prevent metal entry into plant root

(Prasad, 2004).

Tolerance

- If heavy metals manage to enter inside plant tissues, tolerance mechanisms for detoxification are activated.
- These includes;
  - metal sequestration and
  - compartmentalization in various intracellular compartments (e.g., vacuole)
  - metal ions trafficking

Tolerance cont'd

- chelation of metal ions by releasing several substances for example,
  - organic acids
  - Polysaccharides
  - phytochelatins (PCs) and
  - metallothioneins (MTs)

(Manara, 2012).

Activation of antioxidant

- Activation of antioxidant defense mechanisms is pursued as the last act of defense
- These includes enzymes such as:
  - superoxide dismutase (SOD)
  - catalase (CAT)
  - guaiacol peroxidase (POX)
  - glutathione peroxidase, ascorbate peroxidase (APX), glutathione reductase (GR)
  - polyphenol oxidase (PPO)

Activation of antioxidant Cont'd

- free radical scavengers, such as:
  - carotenoids (car)
  - ascorbate (ASC)
  - Tocopherols
  - glutathione (GSH) and
  - total phenols (TP)
  - These are located in various sites throughout the cell of plant.

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THANK YOU

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