ABSTRACT

The study the efficacy of polydentate transition metal complexes of essential trace elements over conventional micronutrient supplements is an emergent field of research for solving micronutrient deficiency in the plants. The vast interest in this field has stemmed from the fascinating features (like less toxicity, less reactivity and environment friendly nature, *etc.*) of these polydentate transition metal complexes. In the present dissertation three first row transition elements, *viz.*, Zn, Cu and V (which are micronutrients for plants) have been chosen for complexation with some polydentate ligands and their effects on various morphological and biochemical parameters are thoroughly studied with four plant subjects, *viz.*, papaya, chickpea, rice and mung bean.

Chapter I is an introductory one that describes micronutrients, their role in plants body, reasons of micronutrient deficiencies, problems of conventional micronutrient supplements and the methods to solve the micronutrient deficiencies in an alternative environment friendly pathway using transition metal complexes of some polydentate Schiff base ligands as potent micronutrient supplements.

Chapter II details the chemicals and materials used in this research work. A brief description of various physico-chemical and spectroscopic techniques, *viz.,* elemental analysis, FTIR spectroscopy, UV-Visible spectroscopy, AAS, specific conductance *etc.*, used for the physico-chemical characterization of the synthesized complexes and various scientific protocols for different biochemical analyses have also been given.

In chapter III, morphological and biochemical effects of four N_2O_2 donor Schiff bases and their Zn^{2+} complexes on *Carica papaya* L. and *Cicer arietinum* L. are presented. Four different Schiff base ligands and their Zn^{2+} complexes are first synthesized and then characterized by different analytical and spectroscopic techniques. To investigate their effects papaya and local chickpea seeds are treated with each ligands and their Zn^{2+} complexes and different morphological and biochemical parameters are monitored. Among all the ligands (L1-L4) and their complexes (C1-C4) it is found that complex (C4) shows the maximum efficacy when treated as a micronutrient supplement for *Carica papaya* L. and *Cicer arietinum L.*

In Chapter IV, morphological and biochemical effects of two azo functionalized N_2O_2 donor Schiff bases and their Cu^{2+} complexes on rice plants

(*Oryza sativa* L.) are presented. Two different ligands and their copper complexes were synthesized and then characterized by both spectroscopic and elemental analyses. Investigations were done by taking rice seeds as plant material. Various growth and biochemical parameters were monitored by taking different concentrations of $CuSO_4$, the prepared ligands (L5 and L6) and their Cu(II) complexes (C5 and C6). Analysis of various biochemical results revealed that the Schiff base Cu(II) complexes (C5 and C6) have less toxic effects than copper sulfate on rice seedlings and thus facilitates better tolerance to copper toxicity than copper sulfate.

In Chapter V, efficacy of a N_2O_2 donor Schiff base (L7) and its vanadyl complex (C7) on various morphological and biochemical parameters of mung bean (*Vigna radiata L.*) are presented. The Schiff base polydentate ligand is synthesized by the condensation of benzidine and benzil in ethanolic medium. The formed ligand was condensed further with $VOSO_4.xH_2O$ to get the corresponding vanadyl complex. Both the ligand and the complex were characterized by spectroscopic and elemental analyses. Mung bean was selected as a plant material. Various morphological and biochemical parameters, *e.g*., leaf senescence assay, chlorophyll content, different reactive oxygen species (ROS) were estimated and were compared to those with ammonium vanadate. Outcomes of the experiments revealed that the Schiff base complex has less toxic effects than ammonium vanadate on mung bean seedlings and provide better tolerance to vanadium toxicity. Though different stress marker and reactive oxygen species accumulation were less and minimum pigment damage was noticed in the Schiff base complex (C7) treated seedlings but the optimum positive impact largely depends on the dose. Beyond certain concentration the complex may show inhibitory effects on the plants. Therefore the present study revealed that heavy metal Schiff base complexes can be used as potential supplement to meet up micronutrient deficiency.

Finally chapter VII contains the concluding remarks of the research works embodied in this thesis.