

Physiological effects of transition metal complexes on *Hordeum vulgare*

A. B. PATIL

P. N. College, Pusad, Pin - 445 216 (India).

(Received: October 02, 2008; Accepted: November 12, 2008)

ABSTRACT

The effects of biological important ligands, levodopa (LDP) and ampicillin (AMP) and their binary and ternary complexes using aspartic acid (ASP) as a primary ligand with biological important divalent transition metal ions (Co, Ni, Cu and Zn) on germination, survival, seedling height etc. on *Hordeum vulgare* (barley or jav) plant was studied at 303 K. Experiments show that binary and ternary complex solutions of Co (II) may function as plant growth regulator, ternary complex solution giving good results as compare to binary, provided that *Hordeum vulgare* seeds are soaked in complex solution of pH 5.00 for 12 hours.

Key words: Transition metal complexes, *Hordeum vulgare*, germination, survival, seedling height.

INTRODUCTION

The information about the role of metal complexes in biological systems their concentrations and presence in different equilibrium¹ is of immense importance. The role of ternary complexes in storage and transport of physiological active substances have been studied by Dixon and Web². The complexes of transition metals with bis-allyl thiourea were reported to have herbicidal and plant growth regulating activity in wheat and cucumber by Daverski *et al*³. Activity of thiocyanates of titanium as plant growth regulators has been reported⁴. The complexes of piperidine-2-carboxylic acid with some bivalent metal ions have been reported to be useful in agriculture as plant growth regulators⁵. Iqbal *et al*⁶ have studied the effect of penicillin G (antibiotic) on seed germination and subsequent seedling growth of *Clitoria ternatea*.

EXPERIMENTAL

The applications of complexes, in general, were studied by dissolving it in proper solvent at desired pH⁷ or it was formed during the reactions. The biological applications of complexes were therefore studied in aqueous medium at pH 5.0, 7.0 and 9.0 at constant ionic strength 0.1 M KNO₃ at 303 K.

The experiment was carried out by selecting Co (II), Ni (II), Cu (II) and Zn (II) as metal ions, ASP as primary ligand and LDP and AMP as secondary ligands.

Soil

Fertilized soil was collected from agriculture land, stones and other hard materials were removed from it. It was then grinded and filtered. The finely powdered soil and filtered sand

was mixed in 1:1 ratio. This soil was then filled in four wooden trays having compartments of equal size. The soil in the tray was moistened with water. Sowing of seeds was done in this soil after one hour.

Experiments performed

1. The healthy grains of barley (*Hordeum vulgare*) of equal size were selected. One thousand seeds were soaked in water for four hours; from these, fifty seeds in each were immersed in distilled water, secondary ligand solution, and solutions of binary and ternary complexes at pH 7.00 for 6 hours. The soaked seeds were taken out of each solution and wash with distilled water. The seeds were sowed in soil kept in wooden trays in a row of fifty. The experiments were carried out during 10th December 2007 to 5th January 2008.
2. Effect of binary and ternary complexes of Co (II) and Cu (II) on the growth of barley plants was studied at different pH (5.00, 7.00 and 9.00), the seeds being immersed in experimental solution for 6 hours.
3. Effect on the growth of barley plants was studied at constant pH 5.00 by immersing the seeds in binary and ternary complexes of Co (II) and Cu (II) from 6, 12, 18 and 24h time interval.

Parameters

Plant growth was decided on the basis of

parameters such as percentage of germination, survival, seedling height (shoot length, root length and root / shoot) and thickness of young leaf.

The germination was noted after 2 ½ days of sowing barley seeds.

The survival was noted after 9 days.

After noting the survival of the plants, they were taken out of the soil and the parameters were measured.

RESULTS

It is observed that percentage survival of seeds is more than that of percentage germination in many cases. This is due to the fact that some seeds germinated after recording percentage germination.

In general, the plant growth activity of ternary complexes is more than binary complexes.

Barley seeds soaked for 12h in solution at pH 5.0 give good results of percentage of germination, survival, seedling height etc.

The general order of plant growth regulators is found to be [Cu (II) - ASP-LDP] > [Co (II)-ASP-LDP] > [Cu (II) -LDP] > [Co (II)-LDP] > Control

ACKNOWLEDGEMENTS

The author is thankful to UGC and Principal, P. N. College, Pusad for providing necessary facilities.

REFERENCES

1. Vacca, A. *Nato. Adv. Study Inst. Ser. C64*: 157 (1980).
2. Dixon, M. and Web, E.C. *Enzyme, Green and Co.*, London (1964).
3. Vesile, V.G., Genchev, M. and Daverski, K. *Dolk. Bolg. Akad. Nauki*, 32(12): 1705 (1979).
4. Bochland, H. and Steinecke, H. "Plant Growth Regulator", *Proc. Int. Symp.*, 385 (1975).
5. Adams, C. M. and Berhays, E. A. *Entamol. Exp. Appl.*, 23: 101 (1978).
6. Ahmad, S., Khan, S. S., Iqbal, S. A. and Khan, M. N. *Orient J. Chem.*, 16(1): 139 (2000).
7. Cruickshank, R. "Medicinal Microbiology", 11th Edn., The English Language Book Society, London 894 (1965).