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EFFECT OF SOME ORGANIC NITRATES ON GERMINATION OF *CENCHRUS BIFLORUS* ROXB SEEDS

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ABSTRACT

Effect of some organic nitrates on seed germination of *Cenchrus biflorus* was investigated. Of the three organic nitrates nitroglycerine and isosorbide mono-nitrate stimulated seed germination in the dark. Nitroglycerine significantly (P at most 0.05) enhanced the final germination percentage at 0.1mM to 100mM, isosorbide mono-nitrate elevated the final germination percentage only at 10 and 100mM while isosorbide di-nitrate did not significantly alter the total germination percentage over the controls.Potassium nitrates stimulated germination only at high concentration. Results are discussed in relation to the effect of organic and inorganic nitrates and nitrites and their possible mode of action.

Key Word: Organic nitrates, nitrites, germination, *Cenchrus biflorus*

INTRODUCTION

The stimulatory effect of inorganic nitrates and nitrites are frequently reported as exerting a marked stimulation on seed germination of a wide range of species (Roberts and Smith, 1977; Bewley and Black, 1994). In particular, this effect has been recorded for dicotyledonous seeds as well as seeds belonging to the family Poaceae (Mayer and Poljakoff-Mayber, 1989). Furthermore, nitrate is known to interact with light impacting seed germination (Grubisic and Kongevic, 1990).In *Sisvmbrium officinale*, changes in sensitivity to light and nitrate accompany the seasonal rhythm of dormancy, i.e. sensitivity to both factors is low at time of deepest dormancy (Bewley and Black, 1994). However, as far as we know there is no general agreement with regard to the action of nitrate in the germination process. Although numerous studies exist on the action of inorganic nitrate or nitrite (Quadri and Cavers, 2000), little attention has been paid on organic nitrate or nitrite. The present study, investigates the impact of some organic nitrates and nitrites on seed germination of a common grass species *Cenchrus biflorus*.

MATERIALS AND METHODS

The seeds of *Cenchrus biflorus* Roxb. were collected from Karachi University campus and surface sterilized with 1% sodium hypochlorite, and washed with double distilled water. Twenty healthy seeds were placed on Whatman No. 1 filter paper in 9cm diameters sterilized Petri plates. Three organic nitrogen compounds were used: nitroglycerine, isosorbide mono nitrate and isosorbide dinitrate. For the purpose of comparison, potassium nitrate and nitrite were also tested. Following concentrations were prepared for each compound: 0 (distilled water), 0.01, 0.1, 1.0, 10 and 100mM. The organic nitrogen compounds were obtained from local pharmaceutical companies. Each Petri dish received 5ml of test solution or distilled water (control). Treatments and controls were replicated five times and randomized in the growth cabinet. Seeds were allowed to germinate at 30º C in dark. Petri plates were examined for germination upto 10 days.

RESULTS AND DISCUSSION

The results for seed germination in response to organic nitrates are presented in Fig. 1a and those for inorganic nitrate and nitrite are given in Fig. 1b. Of the three organic nitrates nitroglycerine and isosorbide mono-nitrate stimulated seed germination in the dark. While nitroglycerine significantly (P at most 0.05) enhanced the final germination percentage at 0.1mM to 100mM, isosorbide mono-nitrate elevated the final germination percentage only at 10 and 100mM. Isosorbide di-nitrate did not significantly alter the total germination percentage over the controls. Examination of the influence of inorganic nitrate and nitrite disclosed that only potassium nitrate at 100mM significantly ($P < 0.001$) enhanced the final germination percentage over the controls. The stimulatory effects of both organic and inorganic nitrate suggest that they might act the same site. The biochemical nature of the mode of action of these chemicals may be conjectured by looking at their physico-chemical properties. The chemicals used in this study differ considerably with regard to their solubility in water. KNO_3 is a highly water soluble compound. On the other hand, the organic nitrates used in this study are relatively less hydrophilic. We

presume that the site of action of both organic and inorganic nitrates is lipophilic then the disparity with respect to final germination percentage can be explained with respect to their oil-water partition coefficient (Needleman and Johnson, 1975). It is suspected that the rates of absorption of these compounds in the seed coat vary to a greater or lesser extent. Thus, the possibility of differential uptake of the active compound can not be ruled out. It is possible that the nitrates interact with darkness resulting in the promotion of seed germination. The effect of these compounds under light was not investigated because the seeds of *C.biflorus* failed to germinate under light. It would be interesting to observe the effect of these nitrates on germination of those seeds that germinate under both light and dark but yield lesser final germination percentage in dark.

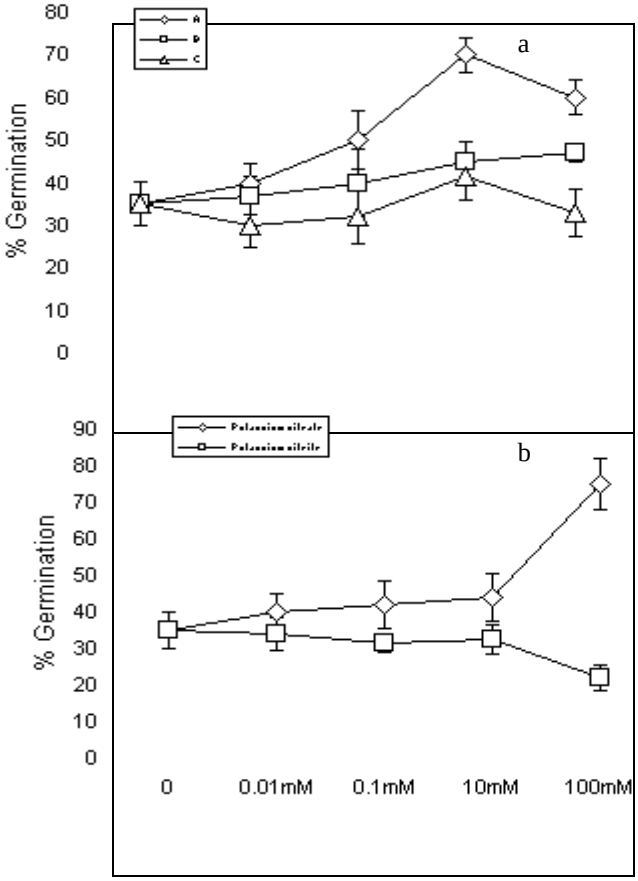

Fig 1. Effect of some organic nitrates on final germination of *Cenchrus biflorus* seeds.
A) nitroglycerine, B) isosorbide mono-nitrate, C) isosorbide di-nitrate.

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