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SEEDLING GROWTH STUDIES OF *PHASEOLUS ACONITIFOLIUS* AFTER TREATMENT OF SEEDS WITH A MORPHACTION, GA_3 AND IAA[1]

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ABSTRACT

Hypocotyl and root lengthening, fresh weight per seedling and dry weight changes in *Phaseolus aconitifolius* after treatments with morphactin, GA_3 and IAA have been studied. All concentrations of morphactin and higher concentrations of IAA had inhibitory effects on hypocotyl and primary root length. IAA, however, promoted the growth of secondary laterals. Rapid loss of dry matter from cotyledons of GA_3 treated seeds indicated its rapid translocation to the growing axis which had greater accumulation in comparison to control while cotyledons of morphactin treated seeds had retained the dry matter to a large extent. Epicotyls of GA_3 and IAA-treated seeds showed greater dry matter accumulation as compared with control.

INTRODUCTION

Effect of morphactins on seed germination and the growth of seedlings has been studied in many plants such as lettuce (Sankhla and Sankhla, 1968), cotton (Kaushik and Lal, 1974), *Cicer arietinum* (Mohan Ram and Mazumdar, 1977), *Lycopersicon esculentum* and *Brassica clearance* (Jain, 1979). Extensive studies have also been carried out with GA_3 and IAA which usually have promotive effects on different growth processes in plants (Halevy and Cathey, 1960 ; Laloraya and Rai, 1962) unlike morphatins (Schneider, 1970). However, no attempt had been made earlier to undertake a comparative study of post-germination changes in various seedling parts after treatments with morphactin and other growth regulators except for report by Gupta and Mukhejree (1982). It was of interest, therefore, to make a comparative study of growth in *Phaseolus aconitifolius* after treatment with various growth regulators. In the present paper, the effect of aforesaid growth regulators was studied on fresh weight and percent dry-weight changes in different seedling parts besides root and hypocotyl elongation.

MATERIAL AND METHODS

Morphologically uniform seeds, (found to have least variability experimentally) of a legume *Phaseolus aconitifolius* were treated with 20% H_2SO_4 for 2-3 min. followed by thorough washing with distilled water. Thereafter, seeds were placed either in distilled water or different solutions of morphactin (CME 74050), (2.73×10^{-4}, 10^{-5}, $10 \times^{-6}$M), GA_3 (2.88×10^{-4}M $\times 10^{-6}$) and IAA (2.85×10^{-4}, $\times 10^{-5}$, $\times 10^{-6}$M) at a temperature of

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$32 \pm 1°C$ in a B.O.D. incubator for 48 hr. Germinated seeds were taken out and after thorough washing, transferred to Petri dishes containing moistened filter paper discs (Whatman No. 1). They were allowed to grow under constant light of 970 Lux provided by a fluorescent tube in a growth chamber set at $32 \pm 1°C$ and observations were recorded for 48 hr after soaking (initial stage) upto 163 hr (120 hr. stage) at an interval of 24 hr.

RESULTS AND DISCUSSION

All concentrations of morphactin and 2.85×10^{-4}M concentration of IAA checked the rate of hypocotyl lengthening, while GA_3 had little promotive effect at all stages of seedling growth (Fig. 1). The inhibition of hypocotyl elogation by morphactin has also been reported earlier (Toky and Nanda, 1970 ; Kaushik and Lal, 1974) and by IAA (Chakravarti, 1958) with pre-sowing treatments of *Phaseolus aureus* seeds with various growth regulators including auxins. The moderate promotion of hypocotyl growth by GA_3 also finds support from several studies (Khan *et al.*, 1957 ; Halevy and Cathey, 1960; Frankland, 1961; Laloraya and Rai, 1962a). The hypocotyl growth response to added GA_3 may be of varied types *viz.*, showing little, moderate or marked promotion was interpreted earlier in terms of the endogenous levels of auxin and gibberellin concentrations in the specific tissues (Laloraya and Rai, 1962b).

Morphactin also inhibited the root length like hypocotyle significantly at $\times 10^{-4}$M. GA_3 did not cause appeciable change in root length but $\times 10^{-4}$M concentration showed a slight inhibition at a later stage. Blesa and Gomez (1966) while working on wheat seedlings reported the root growth inhibition by GA_3 No appreciable change was noticed in root length by IAA at early stages followed by a check of the primary root and promotion of the growth of secondary laterals which gave the appearance of jumbled rootmass. Excessive growth of secondary laterals was observed in *P. mungo* by Laloraya and Rai (1963).

The data on the fresh and dry weight changes of various seedling parts are summarized in Figs. 2-4. Initially, the fresh weight of cotyledons per seedling from treated seeds had higher values than control. Subsequently, rapid loss of fresh and dry weight in cotyledons of GA_3-treated seeds may indicate the translocation of dry matter to the hypocotyl and root which showed its higher amount than the control at 120 hr stage. Halevy *et al.* (1964) pointed out earlier that the reduction in the dry weight of the cotyledons was caused mainly by translocation to the hypocotyl. On the contrary cotyledons from morphactin and IA-pre-soaked seeds caused an increase of about 200% and 217% respectively in comparison to control at 120 hr stage and it was interesting to note that shedding of cotyledons was delayed in IAA-treated seed samples. Cotyledons of treated and control seedlings showed a decreasing pattern in the fresh and dry weight with growth. The maximum decline in % dry weight of cotyledons with seedlings growth was caused by GA_3 (48%) followed by IAA and morphactin (25%) in order at $\times 10^{-4}$ M as compared with control at 120 hr stage. Retention of % dry mass in cotyledons of morphactin treated seeds indicate slow breakdown of reserve food material (Gupta and Mukherjee, 1981), due to its apparent inflence over various mobilizing enzymes as suggested by Schneider (1970).

Initially and also at 120 hr stage, fresh weight of hypocotyl per seddling in

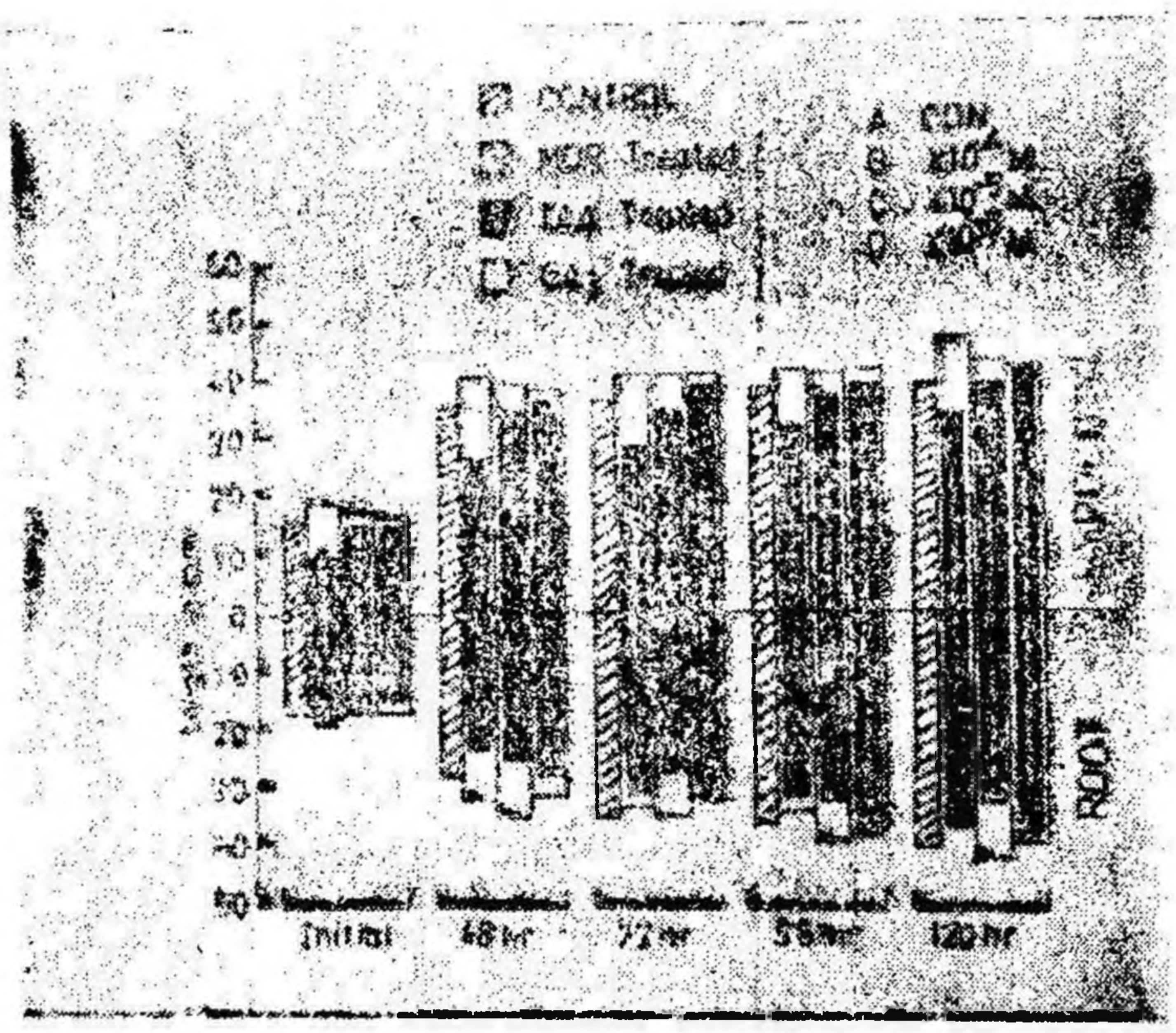

Fig. 1. Effect of morphactin, GA_3 and IAA on the root and hypocotyl lengthening of *P. aconitifolius* seedlings.

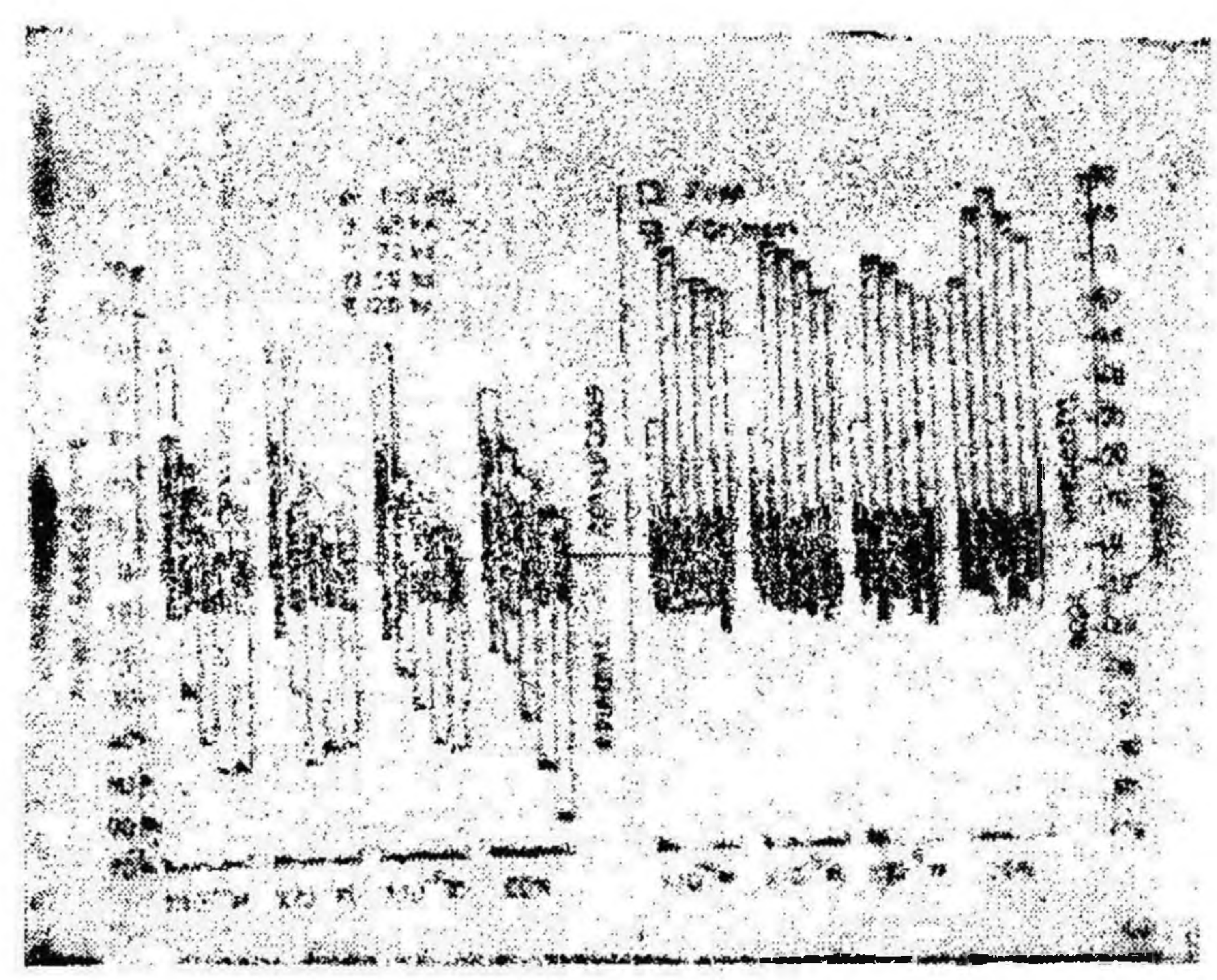

Fig. 3. Effect of 48 hr seed treatment with GA_3 on fresh weight/seedling and % dry mass in different seedling parts of *P. aconitifolius*.

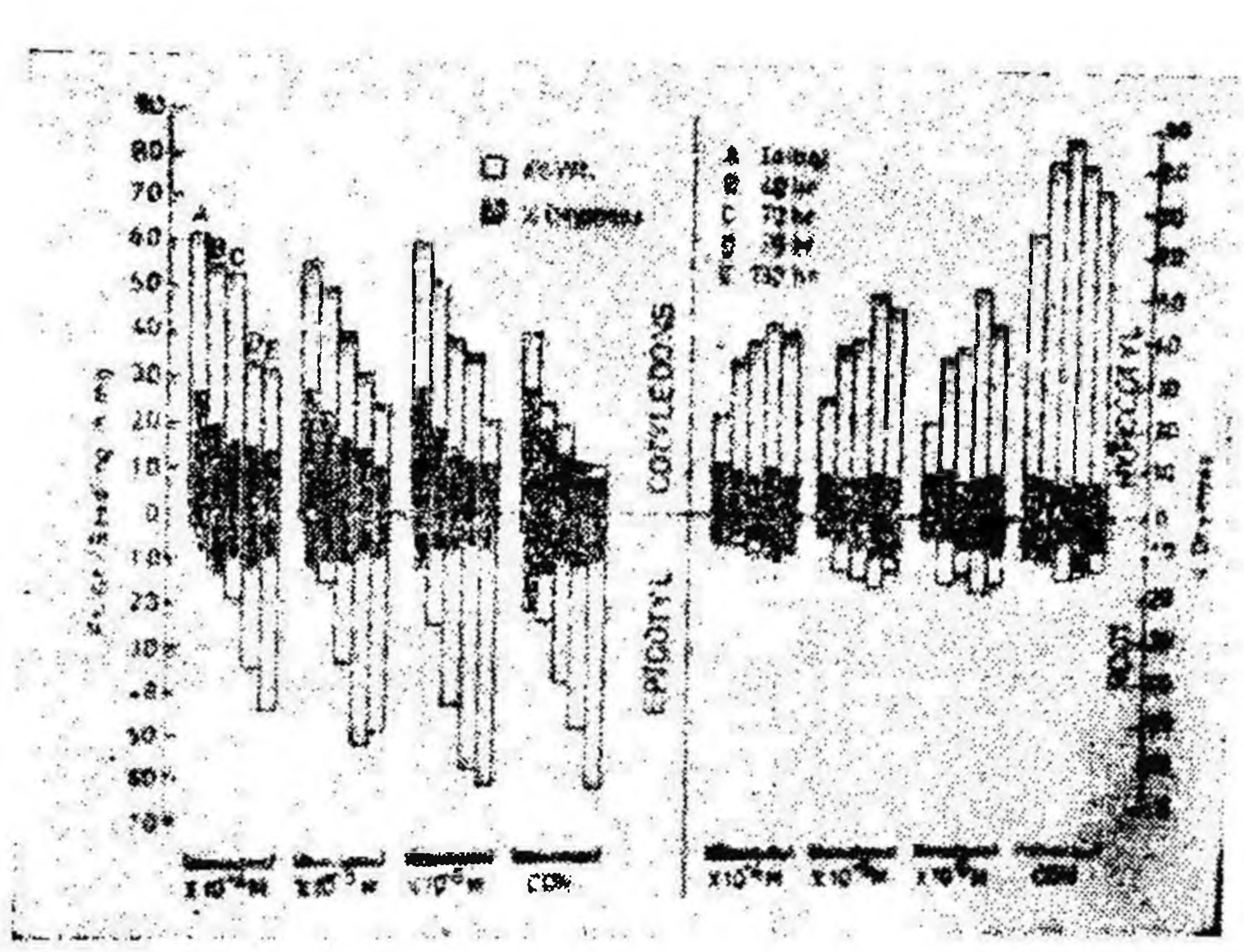

Fig. 2. Effect of 48 hr seed treatment with morphactin on fresh weight/seedling and % dry mass in different seedling parts of *P. aconitifolius*.

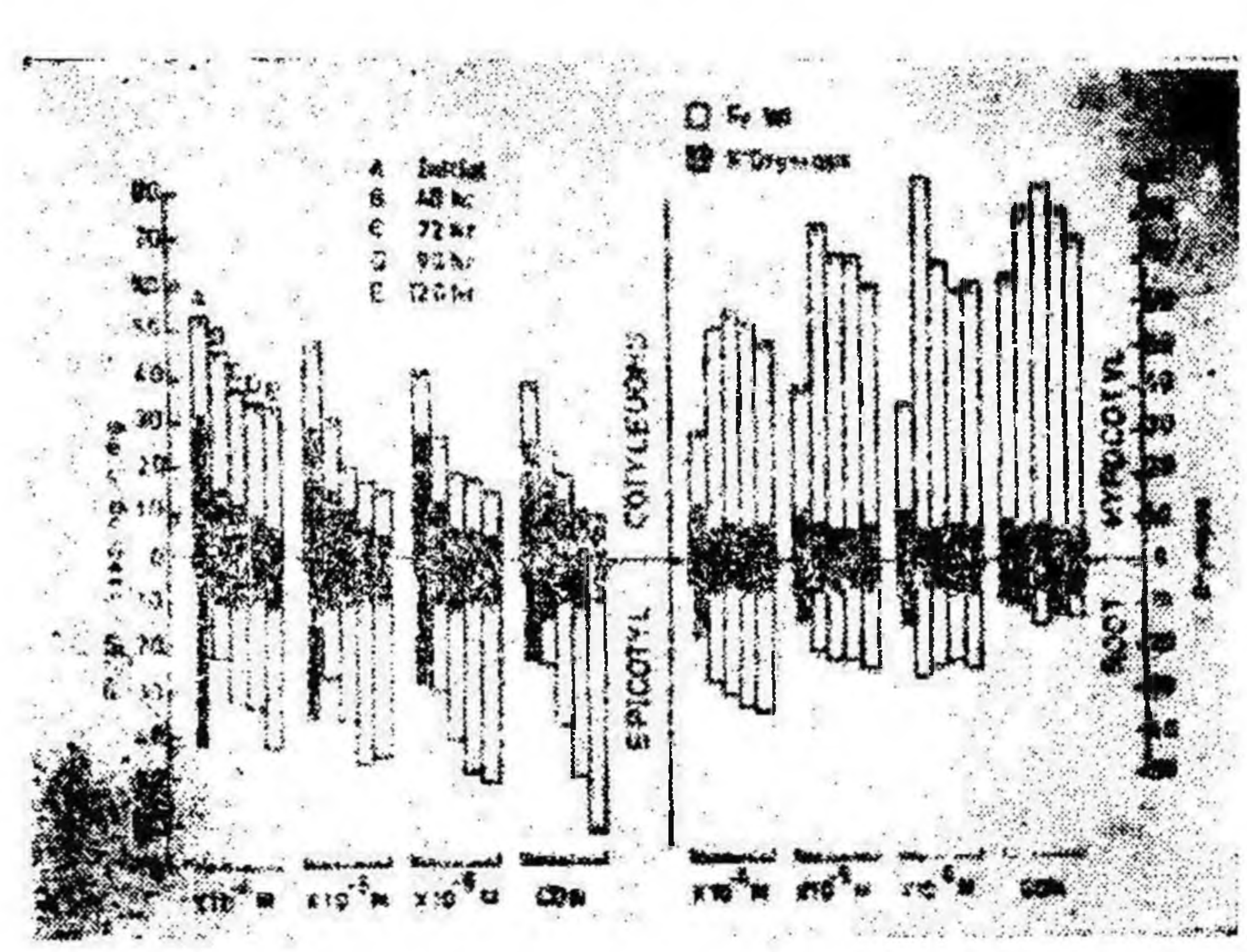

Fig. 4 Effect of 48 hr seed treatment with IAA on fresh weight/seedling and % dry mass in different seedling parts of *P. aconitifolius*.

all treated samples were lower than control. Fresh weight, however, recorded a sharp increase upto 48 hr stage followed by a decrease irrespective of pre-soaking treatments. Hypocotyls subjected to either GA_3 or morphactin treatment showed accumulation of dry matter. Dry matter accumulation in the gorwing axis of of *Cicer arietinum* pre-soaked with morphactin was reported earlier by Mehta *et al.* (1974).

At initial stage (48 hr after seed treatment), the roots in all treatments showed lower fresh weight than control. Thereafter, from 48 to 120 hr stage, with further growth, 2.73×10^{-4} M concentration of morphactin treated seeds maintained the low fresh weight values in roots while lower morphaction concentrations could cause a slight increase in fresh weight values when compared to control. IAA exhibited a different pattern that fresh weight of root/seedling was much higher in various concentrations, the maximum of about 177% recorded in A 10^{-4} M IAA. A considerable accumulation of % dry mass was noticed in roots of those seedlings raised after GA_3 treatment while morphactin and IAA could not cause much difference from those of controls.

It was interesting to note that although all treated samples had lower fresh weight, seedling when compared to control in case of epicotyls, there was an accumulation of % dry matter in treated samples of GA_3 and IAA while morphactin treated samples had similar or little lower values like those of control.

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