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EFFECT OF SOME PHENOLS AND GA_3 ON, GERMINATION, EARLY SEEDLING GROWTH AND α-AMYLASE AND PROTEASE ACTIVITY OF *CICER ARIETINUM* L.[1]

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ABSTRACT

The effect of β-naphthol, resorcinol phloroglucinol and GA_3 was studied on seed germination and seedling growth of *Cicer arietinum* L. Germination percentage rem in uneffected under all the treatments. Phenols and GA_3 promoted the plumule and radicle growth at 10 and 100 mg/l concentration while 500 mg/l retarded it. GA_3 antagonised the inhibitory effect of higher concentration of phenols. Lateral root development was retarded by GA_3 and was enhanced by low concentration of phenols. α-Amylase and protease activity were promoted at low and retarded at high concentration of both GA_3 and phenols.

INTRODUCTION

Kumar and Tayal (1982) found enhancement of radicle and plumule growth by low concentrations and inhibition by higher concentrations of various phenols in lentil and mungbean. GA_3 was found to antagonize the inhibition caused by phenols in *Cajanus cajan* (Tayal and Sharma, 1981). α-Amylase activity was also affected by GA_3 *in vivo* (Chrispeels and Varner, 1967). In order to confirm the above findings and to have a better understanding of seed germination and seedling growth in legumes, the present work was under- taken to study the effect of phenols, alone and in combination with GA_3 on seed germination seedling growth, α-amylase and protease activities, in *Cicer arietinum*.

MATERIAL AND METHODS

Seeds of *Cicer arietinum* cv. C-235, procured from local seed store were properly sterilized with calcium hypochlorite and sown in petridishes (12 cm dia), cushioned with double layers of Whatman filter paper. Ten seeds were placed equidistantly in each petridish and three replicates were taken for each treatment. Solutions of β-naphthol resorcinol, phloroglucinol and GA_3 were prepared in 10, 100 and 500 mg/l concentrations. Phenolic solutions alone and in combination with GA_3 were used as shown in Table I. 1 ml of different solutions was added to respective peridishes in which 5 ml of distilled water had already been added, 6 ml of distilled water was added in one set of petridishes, to serve as control.

All extractions were done at 4°C temperature, 35 grams seeds (Table I) from each samples were separately crushed and homogenized in prechilled mortar and pestle in ice cold acetate buffer (pH 5.2). Homogenates were

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filtered through a double layer of cheese cloth and centrifuged at 4000 rpm for 10 min. The supernatant was precipitated with ammonium sulphate between zero and 80% saturation. Precipitates, collected by centrifugation at 16000 rpm for 15 min were dissolved in 10 ml of acetate buffer for each sample These solutions were used to determine amylase and protease activity by the method described by Mahadavan (1975).

Three days after germination the length of plumules radicles and the number of lateral roots was noted. *a*-Amylase and protease activity was studied *in vivo*.

OBSERVATIONS

None of the concentrations of used chemicals affect the germination percentage. Phenols and GA_3 both in 10 and 100 mg/l concentrations enha-

TABLE I

PERCENTAGE PROMOTION/INHIBITION OF PLUMULE, RADICLE AND NUMBER OF LATERAL ROOT OF *Cicer Arictinum* BY THE APPLICATION OF PHENOLS AND GA_3 ALONE AND INCOMBINATION.

Treatment	% Germination	% Plumule growth promotion/inhibition	% Radicle Promotion/inhibition	% Lateral roots promotion/inhibition
Control	100	—	—	—
GA_3				
10	+100	+140.0	+20.0	—26.6
100	+200	+220.0	+12.6	—42.9
500	—97	—20.0	+21.2	—56.9
β-naphthol				
10	100	+26.6	+3.6	—2.4
100	97	+61.2	+1.6	—5.4
500	97	—10.6	—12.6	—6.0
Resorcinol				
10	100	+80.6	+18.6	+6.4
100	99	+100.0	+52.8	+8.4
500	98	—20.6	—8.7	—1.6
Phloroglucinol				
10	97	+142.0	+18.6	+3.6
100	98	+162.0	+52.8	+30.8
500	97	—20.6	—8.7	—26.3
β-naphthol+GA_3				
100+100	98	+140.6	+10.5	—40.3
500+100	97	+80.6	—10.6	—50.0
Resorcinol+GA_3				
100+100	100	+160.2	+20.6	—46.4
500+100	97	+90.6	+1.26	—52.0
Phloroglucinol+GA_3				
100+100	100	+230.0	+20.9	—40.0
500+100	100	+130.0	+1.23	—47.0

nce the plumule extenstion, the latter being more promotory. 500 mg/l of all used chemicals have retardation effect on plumule growth. In combinations the retardation caused by 500 mg/l of phenol is antagonized by 100 mg/l of GA_3. 10 and 100 mg/l of all used chemicals also enhance radicle growth while 500 mg/l retard it. The inhibitroy effect of 500 mg/l phenols is found to be antagonized by 100 mg/l of GA_3. The lateral root development is retarded more with the increase in concentration of GA_3. 10 and 100 mg/l of phenols except β-naphthol enhance lateral root development while 500 mg/l retard it. All combinations show remarkable retardation in this process (Table I).

Figure 1 shows a-amylase activity *in vivo* as affected by GA_3 and phenols.

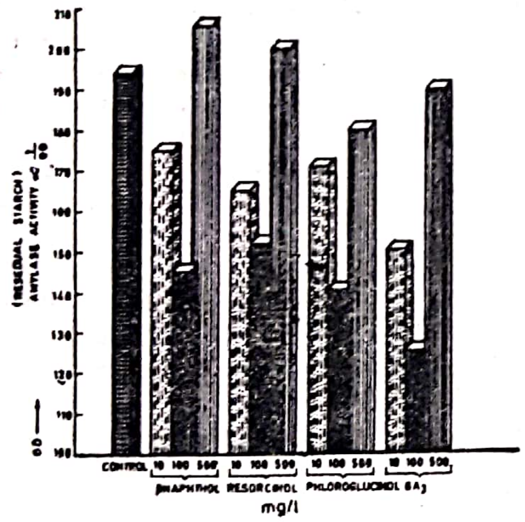

Fig.1. EFFECT OF PHENOLS AND GA_3 ON α AMYLASE ACTIVITY

GA_3 enhances its activity both at 10 and 100 mg/l but retard it at 500 mg/l. Phenols except phloroglucinol retard the activity at 500 mg/l. 10 and 100 mg/l of all being promotroy.

All used phenols increased the protease activity at 10 and 100 mg/l. Phloroglucinol in particular do not retard protease activity even at 500 mg/l. This is against β-naphthol and resorcinol where 500 mg/l showed reduction in protease activity (Fig. 2).

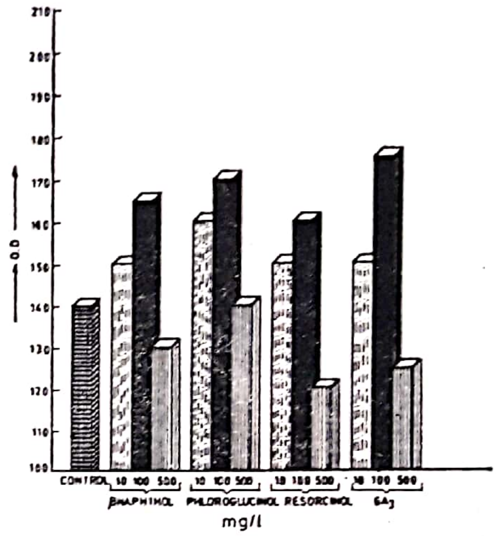

Fig. 2 EFFECT OF PHENOLS AND GA_3 ON PROTEASE ACTIVITY

DISCUSSION

Phenols in the present studies do not affect germination percentage, as is also shown by Tayal and Sharma (1981) and Kumar and Tayal (1982) in other legumenous seeds. These results, however, differ from the early findings of Phillips (1961) and Thakur (1977) where exogenous application of phenols, was shown to cause inhibition of germination in lettuce and sugar mapple.

Enhancement of growth by GA_3 in this case is similar to the findings of Singh and Nanda (1981) in *Callistemon viminalis* L. Retardiation of plumule and radicle growth by 500 mg/l is probably because its being supraoptimal. Frankland and Wareing (1960) had also shown promotion of hypocotyl growth by 10 and 100 mg/l concentrations The retardation of lateral root development by higher concentration of phenols is similar to one obtained by Bendixen and Peterson (1962).

The growth promotion by phenols at low concentration get support from Nanda *et al.* (1977) and Datta and Nanda (1978) who have shown them to increase the number of branches and tillers in *Setaria italica* and in triticale. Retardation of growth by higher concentrations of phenols get support from Miminoshvilli (1973) who found inhibition of carrot tissue growth by phenolic concentration higher than 100 mg/l. The promotion of lateral root development by phenols are according to the results of Dhawan and Nanda (1981).

Interaction studies reveal that promotive concentrations of phenolics behave synergistically with GA_3 as is also shown by Nanda *et al.* (1977) and Kumar *et al.* (1978) The antagonization of inhibitory actions of higher phenolic concentrations by GA_3 in the present studies is similar to one shown earlier by Phillips (1961), Tizio and Paupardin (1971) and Corcoran *et al.* (1972).

The growth promoting effects of GA_3 and phenols may be assigned to facilitated mobilization of stored carbohydrates and proteins. This assumption gets support from our experiments on *a*-amylase and protease (Fig 1 and 2) and also from Kumar and Nanda (1981) who have shown increase in the amount of RNA in GA_3 treated meristematic cells of *Impatiens balsamina*, that can indirectly affect eneyme synthesis. Shastri and Muir (1963) have also shown higher amylase and protease levels in GA_3 treated seeds. Reduction in seedling growth at 500 mg/l of GA_3 and phenols may be because of it's being supra optimal. The inhibition of growth by phenols, might be because of its inhibition of over all metabolism through non-specific metabolic block of ATP synthesis (Khan, 1968).

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