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EFFECT OF GAMMA IRRADIATION ON GROWTH AND PHENOLIC PRODUCTION IN CASTOR BEAN CALLUS CULTURES

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DISEASE resistance in plants to pathogens is largely determined by their ability to inhibit the invades either by penetrating the host or during their development in the tissues by producing phenolic compounds which are fungicidal and bactericidal and are strongly involved in protecting the plant from further damage by compartmentalization of the damaged tissue[1–3]. Plant phenols are, in part, synthesized through the Shikimic acid pathway and are present in abundance in plants. Lignin is one of the ubiquitous phenolic compounds present in plants[4]. Phenolic substances, the active products of cellular metabolism, are of great commercial importance, besides being precursors for lignin biosynthesis and contribute to disease resistance[5] and are used in the manufacture of drugs, antiseptics, insecticides and synthetic dyes.

The present investigation deals with the effect of gamma irradiation on growth and phenolic production in callus cultures of castor grown *in vitro*.

Callus tissue of castor (*Ricinus communis* L., Var 481) obtained from the cotyledon leaf explants grown on Murashige and Skoog's[6] basal medium supplemented with BAP 2 mg/l + IAA 1 mg/l and stock cultures were maintained on the same medium solidified with 1% agar. Freshly grown callus was exposed to varying doses (0.5,1,3,5,10,20,40 Krads) of ^{60}Co γ-source (model 900 BARC) at the Central Instrumentation Centre, Kakatiya University. The irradiated callus (about 200 mg fresh weight) was transferred to non-irradiated fresh medium of the same composition. The cultures were then incubated in diffuse light at 25 ± 2°C. Twelve replicates were used for each of the dose tested and the experiments were repeated twice.

After four weeks of incubation the total extractable phenols were estimated in both the control and the irradiated callus tissues by the Folin method of Swain and Hills[7]. The concentrations of phenolic compounds estimated were expressed in terms of mg, using a standard curve prepared with chlorogenic acid. Fresh and dry (70°C oven dried for 48 hr) callus was measured (table 1).

At a low dose of 0.5 Krad there was a significant stimulation of growth and is followed by sequential decrease in fresh weight from 1 to 10 Krads. At 10 Krad and still higher doses there was no indication of growth for ten days; however, the tissue did gradually attain growth but the growth rate was drastically low and reduced. A remarkable relationship between the tissue growth and phenolic production was noted. Increase in phenol production in the callus is directly proportional to increase in irradiation dose; decrease in fresh weight however, is inversely proportional (table 1). The increase in the production of phenolic compounds in the

Table 1 *Effect of gamma irradiation on growth and phenolic production in callus cultures of castor* (*Ricinus communis*)

Irradiation dose (Krad)	Fresh weight (g)	Dry weight (mg)	Total phenols (mg/g)
Control	3.890	225	5.6
0.5	3.950	237	5.0
1	3.210	186	5.8
3	2.915	174	6.8
5	2.270	136	8.4
10	0.980	63	9.8
20	0.310	21	3.0

Data scored at the end of four weeks, initial inoculum was 200 mg/culture on fresh weight basis and phenolic compounds expressed on mg/g basis.

present study is assoicated with decrease in growth of callus and is comparable to the work of Nash and Devis with Paul's scarlet rose cell suspension cultures[8].

Higher doses of gamma ray cause considerable tissue damage which perhaps in turn leads to the production of more phenols than the control. The reduction of phenolic content in higher doses (20 Krads) may be due to the drastic reduction in growth and 100% lethality in 40 Krads. Estimation of phenols in the same callus tissues after two months led to decrease in phenol content as in Paul's scarlet rose cultures which according to Muhitch and Fletcher may be due to the 'on and off' of the respective genes controlling phenol production[9].

Thus considerable increase in the synthesis of phenolic compounds by irradiating the callus cultures of castor may be utilized in the production of disease-resistant plants, since induction of plant secondary metabolic compounds from plant cells *in vitro* and their subsequent biotransformation is considered one of the promising areas in the biotechnological application of plant cell cultures[10].

Apart from the 'Casbene' which is a diterpine hydrocarbon phytoalexin extracted from cell-free extracts of young seedlings of the castor bean[11]; the present study on phenols in castor callus shows that there is an alternative defence mechanism *in vitro* and *vivo* systems in castor. Further work on the role of Casbene and phenols in relation to disease resistance would be interesting and rewarding since castor is an important oil yielding crop.

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WELDED TUFFS FROM THE MALANI VOLCANICS OF GURAPRATAP SINGH AND DIRI AREAS, PALI DISTRICT, RAJASTHAN

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THE Malani Volcanics of Precambrian age cover an area of 50,000 km^2 in western and southwestern Rajasthan. The rocks of this volcanic suite range in composition from basic to acidic. The presence of welded tuffs from different localities of Malani Volcanic suite has been reported earlier[1,2].

The Malani Volcanics exposed around Guraprata p Singh and Diri Area (Latitude 25° 35′–25° 40′ N and longitude 73°– 73° 10′E) are generally welded tuffs as evident from field and petrographic studies. A majority of known localities of welded tuffs in the world indicate widespread occurrences of welded tuffs in Tertiary and pleistocene times with a remarkable decrease in their number in the older rocks[3], although the recent spurt in Precambrian research has brought to light many ancient examples.

A vast majority of rocks from the present area are fine-grained/glassy with composition varying from basic to acidic. Field studies indicate highly even upper surfaces and gentle dips of flows, except at places where deformation has modified the original attitude. At places layering is recognized, which may be attributed to the various degrees of welding.

The frequent occurrence of glass shards (figure 1a) with varying degrees of distortion due to welding is characteristic of these volcanics. The other petrographic features include the presence of subangular to angular phenocrysts of feldspar (figure 1b), corroded quartz (figure 1c) and collapsed pumice