In vitro formation of roots and rhizomes from anther explants of ginger (*Zingiber officinale* Rosc.)

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ABSTRACT

Anther explants produced callus and profuse roots when cultured in a modified MS Medium containing 2,4-D, and coconut milk and incubated in darkness.

Key words: anther culture, ginger, *Zingiber officinale*.

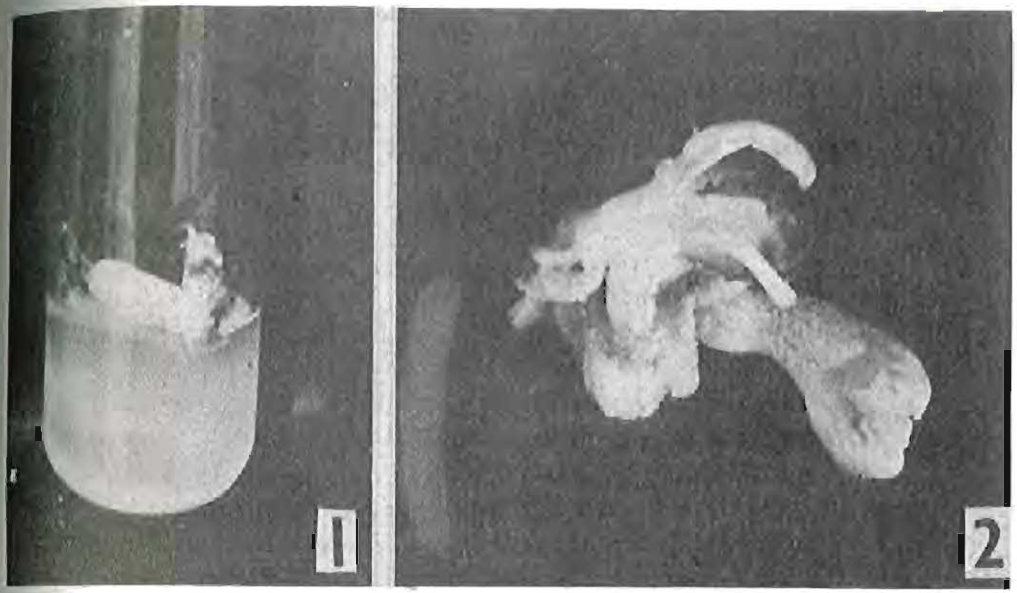
Organs or even whole plantlets have been regenerated, directly or indirectly, from different kinds of explants (Hicks 1980). Anther and pollen culture has been attempted in a large number of higher plants aimed at production of haploid plants (Bhojwani, Dhawan & Cocking 1986). The present communication reports an unusual result obtained during anther culture of ginger. A detailed account relating to anther culture of ginger will be published elsewhere.

The diploid varieties of ginger (2n = 22) have poor pollen fertility. The autotetraploids induced by colchicine, on the other hand, have high pollen fertility (Ramachandran 1982). In the present study, therefore, the anthers of a tetraploid clone of the cultivar 'Maran' were used for anther culture.

The spikelets were subjected to cold treatment at 4°C for 4-7 days. Young flower buds were surface sterilized in 0.1% $HgCl_2$ for 10 min and washed in three changes of sterile distilled water. The single anther from each bud was excised and transferred to medium in culture tubes. The basal nutrient medium of Murashige and Skoog (1963) with various combinations of auxins (2,4-D or NAA) and cytokinins (kinetin or BAP), sucrose (3-6%) and coconut milk (150-200 ml l^{-1}), solidified with agar (0.7%) was used. The pH of the medium was adjusted to 5.8. The cultures were maintained either in darkness at 28°C or given 16 hour light period at 26°C.

Two out of the 80 anthers in medium containing 2,4-D (1.5 mg l^{-1}), coconut milk (200 ml l^{-1}) and sucrose (0.6%) and incu-

bated in darkness at room temperature (28°C) formed callus at the base of anthers and produced in two weeks 6-7 roots with profuse root hairs. A fully developed labellum and two side lobes also formed as in normal *Zingiber* flower (Fig. 1). By the fourth week a horizontally growing rhizome emerged from the callus at the base of the anther showing the characteristic scale leaves and sympodial branching of ginger rhizomes (Fig. 2.).



Figures 1,2. Anther explants of ginger. 1. Two weeks in culture showing development of callus and labellum and side lobes. 2. Four weeks after culture showing development of rhizome.

Though callus formation and organogenesis in vitro is primarily determined by hormones present in the medium, it has also been shown to be influenced by factors such as the nature of the primary explant, sugar concentration and pH of the medium and physical conditions (Hicks 1980). The formation of callus and regeneration of roots and shoot (rhizome) indirectly from callus occurred in the same medium containing 2,4-D and coconut milk in the anther explants. It is known that 2,4-D generally promotes callus formation. The hormones in coconut milk possibly provided the stimulus for root and shoot differentiation. Besides auxins, gibberellins and cytokinins, plant endosperms contain several other uncharacterized growth substances (Naylor 1984). The development of labellum and the side lobes, however, appears to be from primordia which were present at the base of the anther explants.

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