tions, to Prof. A. S. Rao for facilities and to Sri S. Lakshminarayana and Sri P. Veera Raghavaiah for assisting us in photographic work. RVR is thankful to the CSIR, New Delhi for the award of a fellowship.

12 November 1982; Revised 7 March 1983.

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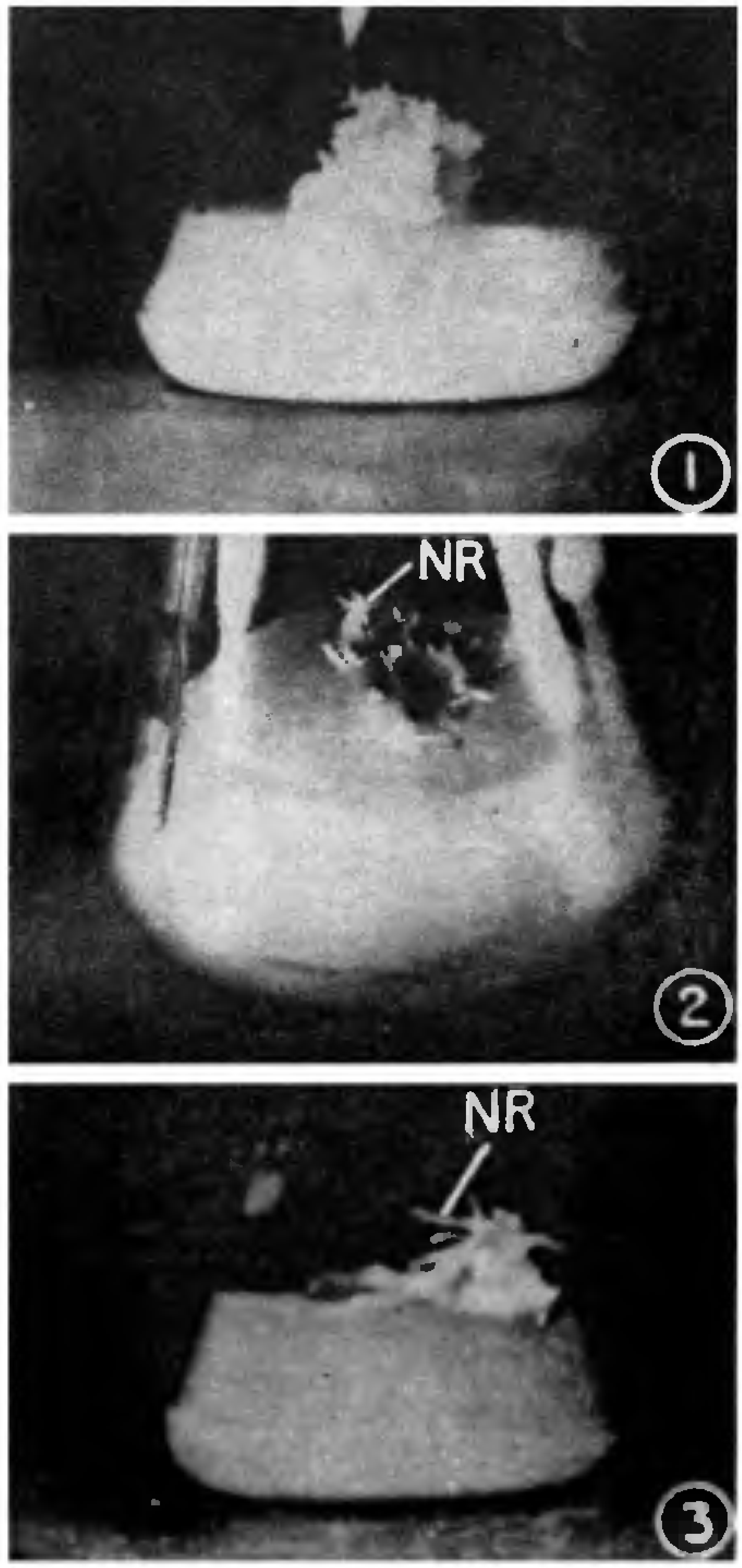
FORMATION OF NEGATIVELY-GEOTROPIC ROOTS IN SHOOT APEX CULTURES OF *CARTHAMUS TINCTORIUS* LINN.

S. C. Goyal and A. Pillai
Department of Botany, University of Rajasthan, Jaipur 302 004, India.

Controlled differentiation and formation of shoots and roots have been reported in tissue cultures of Compositae[1-3]. In the present study negatively-geotropic roots were observed in cultures of shoot apex explants of *Carthamus tinctorius* Linn.

Shoot tips (1 cm) of *C. tinctorius* Linn. from 11-week old plants were surface-sterilized with 0.1% $HgCl_2$ solution for 10 min and washed six times in sterile double-distilled water. Meristems (0.2-2 mm) were dissected aseptically and cultured on Murashige and Skoog's (MS)[4] medium supplemented with various combinations of NAA and kinetin. The following combinations of kinetin and NAA were used in MS media (a) K (0.04 mg/l) + NAA (1.5 mg/l), (b) K (0.08 mg/l) + NAA (1.5 mg/l), (c) K (0.04 mg/l) + NAA (3 mg/l) and (d) K (0.08 mg/l) + NAA (3 mg/l). In media a, b and d



Figures 1-3. 1. Shoot apex culture on MS medium (6 weeks). + (K-0.08 mg/l and NAA-1.5 mg/l). **2.** Shoot apex culture on MS medium with (K – 0.04 mg/l and NAA 3 mg/l) showing formation of negatively geotropic roots (4 weeks). **3.** Subculture on same medium (MS + K – 0.04 mg/l and NAA – 3 mg/l) showing more negatively geotropic roots (6 weeks). (NR, Negatively geotropic roots).

profuse callusing was observed (figure 1). Negatively-geotropic roots were formed in large numbers on medium (c) with high auxin and low kinetin (0.04 mg/l kinetin + 3 mg/l NAA) (figure 2). First callus was formed followed by formation of negatively-geotropic roots two weeks after culturing. The roots which grew away from the callus mass into the air were white, short, stout and showed profuse branching which resulted in anastomoses. Subculturing on the same medium showed continued production of the same type of negatively-geotropic roots (figure 3). The subcultures showed that some of the longer roots are diageotropic. Vasil and Hildebrandt[5] also observed negatively-geotropic roots in *Petroselinum hortense* Hoffm., but did not explain the causative factors. There are certain examples in which they are induced in intact plants or seedlings by various treatments particularly by morphactins[6]. In nature such roots are produced in Mangrove plants and in plants like *Cycas*.

We are thankful to Prof. S. K. Pillai, for going through the manuscript and offering valuable suggestions.

23 December 1982; Revised 25 February 1983

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MUTAGENIC EFFECTS OF HYDROXYLAMINE ON TOMATILLO (*PHYSALIS IXOCARPA* BROT.)

S. K. Mahna, G. G. Saini and Rashmi Gupta
Department of Botany, Government College,
Ajmer 305 001, India.

Tomatillo (*Physalis ixocarpa* Brot.), a vegetable crop plant of family solanaceae has been shown to be a favourable genetic material for induced mutational studies[1]. Hydroxylamine (HA), a well recognised mutagen for micro-organisms has also been used to induce mutations in higher plants[2-4]. An attempt has been made in this investigation to study the effects of HA on tomatillo. Hydroxylamine was found to induce interesting variations in the various parts of the tomatillo. Data obtained from M_1 and subsequent generations have been summarised and evaluated.

Seed samples of tomatillo were soaked in distilled water for 12 hr and treated with freshly prepared solutions of HA (0.06, 0.12, 0.25, and 0.5 M) for 1 hr. Hydroxylamine solution was prepared in 0.2 M sodium borate, pH 7.4 according to Freese *et al*[5]. Seed treatment was carried out at 25° C with intermittent shaking. Treated seeds were washed for 10 min with tapwater and transferred to petriplates and pots respectively. Three weeks old seedlings from pots were transplanted in the fields. A control was also run along with the treated plants. Seeds obtained from M_1 plants were sown to raise M_2 segregating families.

Parameters such as germination, emergence percentage and seedling height were used to determine the biological damage caused by HA in the treated population (M_1). At higher doses, germination, emergence percentage and seedling height were adversely affected (table 1).

In M_1, a large number of characteristic cotyledonary and mature leaf abnormalities were observed. These morphological variations were classified according to the most conspicuous alteration in leaf morphology. At 0.12, 0.25 and 0.5 M concentrations, seedlings showed dumbbell shaped, rolled and fused lamina (figure 1, A–D). In the treated population (0.06, 0.25 and 0.5 M), a few plants showed leaves having mucronate, truncate, obtuse, retuse and obcordate apex (figure 1, F, b–f) as compared to leaf with acute apex in control plants (figure 1, F, a). Two plants were isolated from 0.5 M having leaf with bifurcated mid vein and lamina (figure 1, F, g, h).

A single chlorophyll mutant was found in 0.25 M treated M_1 plants. Mutant produced to types of branches, (A) branches with normal green leaves and (B) branches with variegated leaves (figure 2, B). Seeds collected from variegated branch were sterile, whereas seeds from normal branches produced normal M_2 plants.

Two plants were screened from 0.25 M bearing two fruits at a node instead of one fruit as in control (figure 1, E).

Two viable mutants named as "crumpled leaf" and "fasciated stem" were isolated from M_2 segregating families (0.06 and 0.5 M). In crumpled leaf mutant, the shape, colour and texture of the leaves were affected. Mutant had dark (bluish) green leaves with crumpled lamina and dissected margins (figure 2, A). In fasciated stem mutant, fusion of the petioles of first and second leaves due to stem fasciation, gave a characteristic appearance to the plant (figure 2, C). Stem was