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* Original not seen

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

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CONTROLLED differentiation and formation of shoots and roots have been reported in tissue cultures of Compositae.

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% HgCl₂ 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) 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

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**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 sub-
cultures showed that some of the longer roots are
diagetotropic. Vasil and Hildebrandt\(^6\) also observed
negatively-geotropic roots in \textit{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.

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MUTAGENIC EFFECTS OF
HYDROXYLAMINE ON TOMATILLO
\textit{(Physalis ixocarpa Brot.)}

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TOMATILLO \textit{(Physalis ixocarpa Brot.)}, a vegetable
crop plant of family solanaceae has been shown to be a
favourable genetic material for induced mutational
studies\(^7\). Hydroxylamine (HA), a well recognised mut-
agen for micro-organisms has also been used to induce
mutations in higher plants\(^2\). An attempt has been
made in this investigation to study the effects of HA on
tomatillo. Hydroxylamine was found to induce inter-
esting 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 Free and al\(^8\). Seed
 treatment was carried out at 25\(^\circ\) 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 percen-
tage and seedling height were used to determine the
biological damage caused by HA in the treated popula-
tion \((M_1)\). At higher doses, germination, emergence
percentage and seedling height were adversely affected
(table I).

In \(M_1\), a large number of characteristic cotyledo-
nary 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 obcur-
date apex (figure 1, F, h–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 fas-
ciated stem mutant, fusion of the pitholes of first and
second leaves due to stem fasciation, gave a character-
istic appearance to the plant (figure 2, C). Stem was