

Pakistan J. Sci. Ind. Res., Vol. 15, No. 6, December 1972

EFFECT OF GAMMA COBALT (γ Co⁶⁰) RADIATION ON THE GROWTH AND ALKALOIDAL CONTENTS OF MEDICINAL PLANTS

Part I. *Hyoscyamus niger* L. (Solanaceae)

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(Received May, 24, 1972; revised August 7, 1972)

Hyoscyamus niger L. 'henbane' (khurasani ajvayan) is native of Mediterranean region and temperate Asia and is known in many parts of the world. In West Pakistan it occurs in temperate western Himalayas at the altitudes between 8,000–11,000 ft.

The plant is an erect, viscidly hairy, foetid annual or biennial herb up to 5 ft high. Stem and branches are coarse and hairy. Radical leaves are oblong-ovate and toothed. Stem leaves smaller than radical leaves, ovate, lobed, changing into bracts above. Flowers dark yellowish green, veined with purple, sessile. Fruit, a capsule of $\frac{1}{2}$ in dia enclosed by persistent triangular calyx. Seeds minute and many.²

Henbane is valued principally for the alkaloids present in most parts of the plant, particularly in the leaves and flowering tops. The principal alkaloids present in the various parts of henbane are hyoscyamine (C₁₇H₂₃O₃N; m.p. 106–9°C), and hyoscyne or scopolamine (C₁₇H₂₁O₄N; m.p. 55°C), the later in a smaller quantity.¹

Hyoscyamus has anodyne, narcotic and mydriatic properties, it is principally employed as a sedative in nervous affections and irritable conditions, such as asthma and whooping cough, and is substituted for opium in cases where the later is inadmissible. It is also used to counteract the gripping action of purgatives and to relieve spasms in the urinary tract.¹

Cultivation. Due to the growing demand of the pharmaceutical industry for the alkaloid; hyoscyamine, the present studies were carried out in an attempt to increase the percentage of hyoscyamine by irradiation method. About one kanal land was thoroughly ploughed after addition of sand and cowdung manure. The land was divided in six equal plots. Meanwhile *Hyoscyamus niger* seeds were sent to radiation genetics Institute, Lyallpur, for exposure to γ Co⁶⁰ irradiation in the five doses; i.e. 1, 1.5, 2, 2.5, 3 Krads.

The seeds, when received back, were sown in nursery beds to raise seedlings, alongwith some untreated (control) seeds. The seedlings were transplanted to plots in the month of November; those from untreated seeds in one plot as control and the treated in separate plots for each dose. In early stages of crop, frequent irrigation was done, afterwards it required little irrigation. Leaves were collected in early May, i.e. in early stages of its flowering and were dried in shade for 1 week before chemical analysis.

Hyoscyamine Estimation. For *Hyoscyamus* estimation *Indian Pharmaceutical Codex*, vol. I, 1953,

method with minor modifications was followed. Dried powdered leaves (5 g) were taken for extraction with 4 volumes of ether and one volume of 45% alcohol, containing 6 ml dil NH₃. After complete extraction of the alkaloid (approx 250 ml) the percolate was shaken with dil HCl, until complete extraction was effected (25 × 10 ml). Aqueous extract was shaken twice with 5 ml CHCl₃ to remove chlorophyll. Chloroform extract was shaken with 4 ml HCl and mixed with the major extract. To the major acid extract added dil NH₃ and extracted with CHCl₃ until complete extraction is effected. CHCl₃ extract was washed with H₂O and separated and was left for evaporation of CHCl₃. The residue after drying was dissolved in 1 ml ethanol then 30 ml N/50 H₂SO₄ was added and titration was done against N/50 NaOH, using methyl red as indicator. One ml N/50 H₂SO₄ is equivalent to 0.005784 g hyoscyamine.

Results and Discussion

The crop of henbane showed no evident variation in vegetative morphology. The yield of leaves obtained per dose are given in Table 1.

It is obvious (Table 1) that the irradiation treatment of henbane seeds has increased the yield of leaves. are average of five determinations of samples, obtained from plants of each treatment.

The results show an increase in the percentage of hyoscyamine in treated plants with the exception of

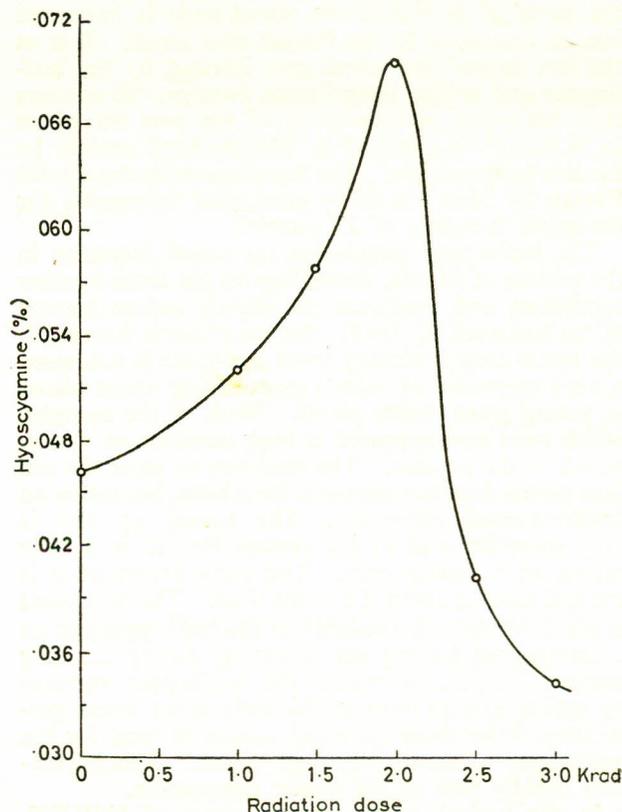


Fig. 1. Percentage of hyoscyamine with relation to different doses of gamma rays.

TABLE 1.

Dose (Krad)	Dry wt of the leaves (g)	Hyoscyamine (%)
1	28	.052
1.5	35	.057
2	40	.069
2.5	38	.040
3	30	.034
Control	25	.046

The increase in leaves output increases with the increase in radiation dose up to certain limit and after that, it decreases. The maximum leaves obtained were in the case of plants given 2 Krad dose, as the increase is 60% as compared to the control plants.

The percentage of hyoscyamine given in Table 1 2.5 and 3 Krad doses where the decrease is evident, particularly in the 3 Krad, the decrease is 24.9%.

The increase in the percentage of hyoscyamine is maximum in plants treated with 2 Krad where the increase is 50.2% (Fig. 1).

Radiation of gamma cobalt in the dose of 2 Krad increased the yield of leaves and the percentage of hyoscyamine 60 and 50.2% respectively in henbane, thus making the radiation trial successful for the commercial exploitation of this vital alkaloid.

Acknowledgements. The authors wish to thank Dr. M. Ikram, for his valuable guidance in the completion of this work.

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