RADIOBIOLOGICAL STUDIES ON *PINUS* WITH SPECIAL REFERENCE TO *PINUS KESIYA* ROYLE EX GORD.

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I certify that the thesis entitled **"Radiobiological Studies on Pinus with special reference to Pinus kesiya Royle ex Gord"** submitted by Mr. S.R. Katiyar for the Degree of Doctor of Philosophy of the North-Eastern Hill University, Shillong, embodies the record of original investigation carried out by him under my supervision. The thesis presented is worthy of being considered for the award of the Ph.D. Degree. This work has not been submitted for any Degree of any other Unviersity.

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CHAPTER I

INTRODUCTION

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The turpentine, which is a natural product, is one of the major source of raw materials to the organic chemicals complex, because attempts to commercially synthesize terpenes have not met with success (Singh and Mehra, 1977). Four resin yielding Pinus species (P. roxburghii, P. kesiya, P. excelsa and P. gerardiana), although occur wild in India, only P. roxburghii is commercially exploited. The other spp. of Pinus (P. kesiya), which grow in N.E. India and yield pinene rich turpentine oil, could not be exploited commercially for various reasons including low yield of oleoresin (Chadha, 1977).

The work done at the Institute of Forest Genetics, U.S.A. has revealed that in many economically important tree species eg., Pinus improvement is hampered since these exhibit limited natural variation and poor hybridization possibilities (Rudolph, 1972). Induced mutations are considered an alternative to naturally occurring variation as the source of germplasm for plant improvement programme and also to hybridization and recombination in plant breeding (Brock, 1971). In pines, somatic mutations may be isolated through repeated vegetative propogation following mutagenic treatment (Rudolph, 1972). Ionizing radiations are increasingly used to induce mutation in plants. However, mutagenic efficiency is determined to a considerable extent by the degree of injuries in M_1 generation (Gaul, 1964; Ehrenberg, 1971) and such injuries also affect the size of M_1 population to be treated (Blixt, 1972). However, no work is available on the comparative radiosensitivity of P. kesiya and P. roxburghii, the two species growing wild in India.

Growth reactions of plants are reflected in the response of shoot apex (Gunckel and Sparrow, 1961). Thus, study of radiation-induced changes in apical meristem becomes pertinent for better understanding of radiation induced growth responses in treated material. Mergen and Thielges (1966) reported that chronic exposure of gamma rays induced maximum cellular injury in apical and axillary meristem of Pinus rigida. Pillai et al., (1980) described shoot apex organization in six Pinus species (P. gerardiana, P. roxburghii, P. wallichiana, P. insularis, P. massoniana, P. pseudostrobus). However, no information is available on the shoot apex organization of P. kesiya. It's responses to radiation also have not been investigated.

Resin ducts are a common feature in Pinus. These are found both in primary and secondary plant bodies (Fahn, 1978). In the primary plant body the resin ducts are found in the root, hypocotyl, shoot and needles and in the secondary plant body these are common feature of wood. The development of resin ducts is similar both in primary and secondary tissues (Fahn, 1978). Resin is synthesized and stored in the resin ducts. Growth hormones and wound etc. influence differentiation of resin ducts (Fahn et al., 1979). Cutter (1978) emphasized the need to find out various factors influencing resin ducts formation. No work is available on radiation effects on either development of resin ducts or secretion of resin in P. kesiya.

Osborne (1957) suggested that crosses with irradiated pollen may result in radiation-induced structural heterozygosity in the chromosomes of progenies thus inducing variability. Irradiated pollen could be effective in inducing parthenogensis production of haploids and overcoming cross incompatibilities in forest trees (Rudolph, 1978). Radiobiological studies on pollen

of forest trees, therefore, become important. But no information is available on the radiobiological aspects of the P. kesiya pollen.

As radiobiological studies in P. kesiya and P. roxburghii were lacking the present study was undertaken to make a comparative study of radiation responses in M_1 generation since this may provide basic information needed for irradiation experiments. The following aspects were considered:

1. Seed germination and seedling survial
2. Seedlings growth
3. Shoot apical meristem
4. Resin duct
5. Pollen germination and pollen tube growth