# RADIOBIOLOGICAL STUDIES IN SOLASODINE YIELDING SOLANUMS

S. RAVINDRAN



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DEPARTMENT OF BOTANY
SCHOOL OF LIFE SCIENCES
NORTH-EASTERN HILL UNIVERSITY
SHILLONG - 793014
INDIA

AUGUST, 1981

phone : 3390
Grams : NEHU

# North-Eastern Hill University

Lower Lachaumiere, Shillong - 793001 (Meghalaya)

Dr. Y.S. Chauhan
Reader

DEPARTMENT OF BOTANY
SCHOOL OF LIFE SCIENCES

I certify that the thesis entitled "RADIOBIOLOGICAL STUDIES IN SOLASODINE YIELDING SOLANUMS" submitted by S. Ravindran 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. He has been duly registered and 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 University.

Date 24.8.81
Place Shillong

Y S Chauhan
Signature of the Supervisor

Forwarded
R.R. Mishra
24/8/81

Head,
Department of Botany
School of Life Sciences
North Eastern Hill University
Shillong, Meghalaya.

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S. Ravindran
S. RAVINDRAN

Morphology & Morphogenesis
Laboratory
Department of Botany
School of Life Sciences
North-Eastern Hill University
Shillong 793 014.

Dated 24-8-1981

D E D I C A T E D  T O  T H E
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C O N T E N T S

CHAPTER I

# INTRODUCTION

Steroidal hormones and corticosteroids have assumed great importance as they are used for various human ailments such as rheumatoid arthritis, addison's disease, chronic cases of asthma, leukaemia and obesity. They are also the active principles of oral contraceptives.

Several natural plant sources have been discovered which yield intermediates for the synthesis of steroidal drugs. Diosgenin, a steroid sapogenin obtained from Dioscorea has been commercially exploited for this purpose. Diosgenin can be converted into 3β - acetoxy - Δ5 - 16 pregnadiene - 20 - one, a key intermediate for the synthesis of steroidal drugs. The same intermediate has been obtained from solasodine (a steroidal alkaloid found in some Solanum spp.) which is a nitrogen analogue of diosgenin (Sato et al., 1951). The realization that the glycoalkaloid solasodine is a suitable alternate raw material for the production of steroid hormones led to a worldwide search for the identification of Solanum species rich in solasodine content and suitable for large scale cultivation. Though a number of Solanum species are reported to yield solasodine in appreciable quantities, only few species occur wildly in India. Amongst these species, Solanum khasianum and Solanum indicum yield solasodine in commercially exploitable amounts (Maiti et al., 1964; Chopra and Kapoor, 1968). However, commercial cultivation of these species have met with limited success because of low berry production resulting in reduced alkaloid yield. Furthermore,

the presence of sharp spines on the aerial parts of the plant and asynchronous flowering poses a serious problem in the harvesting of berries. Therefore the need for an intensive breeding programme to improve solasodine yielding solanums has been emphasised, but the attempts to improve S. khasianum by hybridization have not succeeded (Kaul and Zutshi, 1977). Induction of tetraploidy in this species also did not prove to be promising (Kaul and Zutshi, 1977). Thus the possibilities to improve this species through conventional methods of plant breeding are meagre. Similar were the conclusions of Rudolph (1972) in the case of forest tree species exhibiting poor hybridization possibilities. Induced mutations are considered an alternative to hybridization and recombination in plant breeding (Brock, 1971). Ionizing radiations are increasingly used to induce mutations in plants and many medicinal and aromatic plants have been improved by inducing mutations with gamma rays (Kapoor and Datta, 1967; Kaul and Kak, 1975; Kaul and Choudhury, 1975; Gupta et al., 1979). Gamma rays have been used for the genetic improvement of S. khasianum but the attempts have met with limited success (Bhatt, 1972; Chauhan et al., 1975a, b, 1976). For a successful crop improvement programme using ionizing radiations a thorough understanding of the radiobiology of the species used is essential since great differences (more than 100 fold) exist in the radiosensitivity of different species (Sparrow et al., 1961a,b). Rudolph (1971) considers that information on relative

radiosensitivity of different species under comparable conditions is of value and helps in understanding the radiobiological responses of the species. As radiobiological studies in S. khasianum and S. indicum are 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 survival.
2. Growth and yield.
3. Shoot apical meristem.
4. Flowering responses.
5. Pollen germination and pollen tube growth.
6. Heterostyly.