Gamma irradiation – a potential tool for the creation of variability and selection of mutants with Fusarium wilt resistance in banana cv. Rasthali (AAB, Silk)

Marimuthu Somasundaram Saraswathi*¹, Gandhi Kannan¹, Raman Thangavelu¹, Subbaraya Uma¹ and Thumballi R Ganapathii²

* 1 ICAR-National Research Centre for Banana, Tiruchirappalli, Tamil Nadu, India.

* 2 Bhabha Atomic Research Centre, Trombay, Department of Atomic Energy, Mumbai, Maharashtra, India.

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INTRODUCTION

- Fusarium wilt of banana, popularly known as Panama disease, is a lethal fungal disease caused by the soil-borne fungus *Fusarium oxysporum* f. sp. *cubense* (*Foc*)

- In *Musa* cv. Rasthali, genetic improvement through traditional breeding is extremely difficult, as they are both male and female sterile.

- Under such circumstances, *in vitro* mutation breeding combined with toxin based selection is a promising strategy to develop such resistant varieties.

- In banana, shoot tip cultures are traditionally used for mutagenesis. The main problem with this explant type is the frequent occurrence of chimerism.

- Embryogenic cell suspensions not only allows handling of large population under controlled conditions but also avoids chimerism owing to their single cell origin.
**MATERIALS AND METHODS**

**Variety** : Rasthali (AAB)

**Mutagen** : Gamma irradiation  
(Dept of Atomic Energy))

**Explant** : Embryogenic cell suspension

**Treatments** : 5-50 Gy at 5 Gy intervals

*In vitro* screening:
Fusaric acid - 0.05, 0.075, 0.10, 0.125 & 0.15 mM  
Crude culture filtrate - 4, 5, 6, 7, 8, 9 & 10%

**Pot screening:** Sand maize meal inoculum of Foc race (VCG 0124/5) was applied at the rate of 30g per pot (12 x 10⁹ cfu / ml).
RESULTS

Radio sensitivity curve

Survival percentage

Radiation dose

A - Control
B – 5Gy;  C - 10Gy
D – 15Gy;  E –20Gy
F – 25Gy;  G –30Gy
H – 35Gy;  I –40Gy
J – 45Gy;  K –50Gy
Determination of LD$_{50}$ specific to toxins

Fusaric acid - 0.1mM with 53% survival
Culture filtrate – 6% with 50% survival

Fusaric acid: A – Control; B – 0.05; C – 0.075; D – 0.10; E – 0.125 & F – 0.150 mM

Culture filtrate: G – Control; H – 4; I – 5; J – 6; K – 7; L – 8; M – 9 & N – 10%
**Pot culture studies**

Pot screening against Foc race 1 (VCG0124/5) resulted in the identification of one putative resistant mutant which is free from both external and internal symptoms of fusarium wilt disease.

A. Challenging with spores of *Foc* race 1 @ 30g/pot

B. Negative control – Non treated, inoculated
   Positive control - Non treated, un inoculated
   Resistant - mutant free from disease symptoms
Mutant lines derived from gamma irradiation

RM 100
RM 217
RM 81
RM 64
Field Screening of Mutant derived from Gamma Irradiation
CONCLUSION

- Embryogenic cell suspension (ECS) is the material of choice for *in vitro* mutation induction, as it overcomes the problem of chimeras.

- The optimal dose for the irradiation of suspension was determined as 35 Gy, and it was able to tolerate higher doses than shoot tips and proliferating buds.

- *In vitro* screening is an effective method as it minimizes the handling of non-mutated and susceptible population.

- To determine the effect of gamma irradiation, regeneration efficiency seemed to be an appropriate method than fresh weight gain and settled cell volume, as it facilitates the counting of exact number of plantlets which survived in each treatment.

- Pot screening leads to the identification of mutant which is free from external and internal symptoms of fusarium wilt disease.
CROP IMPROVEMENT TEAM

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