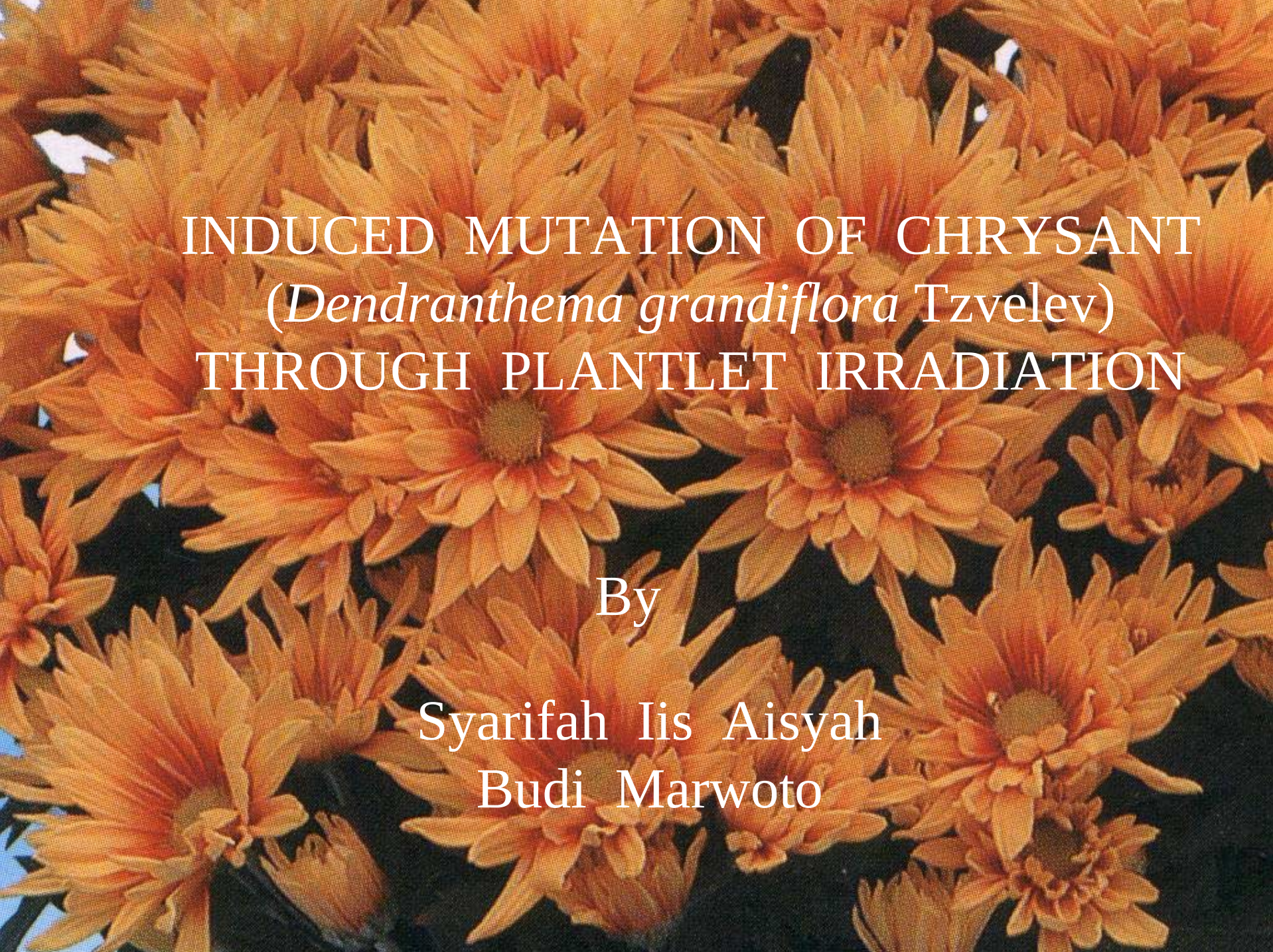

INDUCED MUTATION OF CHRYSANT (*Dendranthema grandiflora* Tzvelev) THROUGH PLANTLET IRRADIATION

By

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INTRODUCTION

- Chrysant : the most popular ornamental plant (as cut flower, border/ potted/ bedding plant)
- In Indonesia, demand of chrysant tends to increase : 9.284.700 stems (1996) →12.220.800 stems (1999)
- Problem : scarcity of high quality seed (or seedling/ cutting)
- Imported seed : expensive → create our own varieties

MUTATION

- Spontaneous mutation
  - Probability : 10^{-6} occur naturally
- Induced Mutation : Mutagen
  - Physic
    - Radiation
      - α , γ , X-ray
    - Non Radiation
      - UV
  - Chemical e.g. EMS, ENU etc

This research, use :

- γ rays → very useful to obtain novel variety in relatively short time
- Chrysant → vegetatively propagated plant

↓

once stabile mutant obtained, can be propagated easily ("true to type")

OBJECTIVES :

To observe the response of chrysant cultivar to γ irradiation

To investigate LD_{50} for each chrysant cultivars

MATERIALS

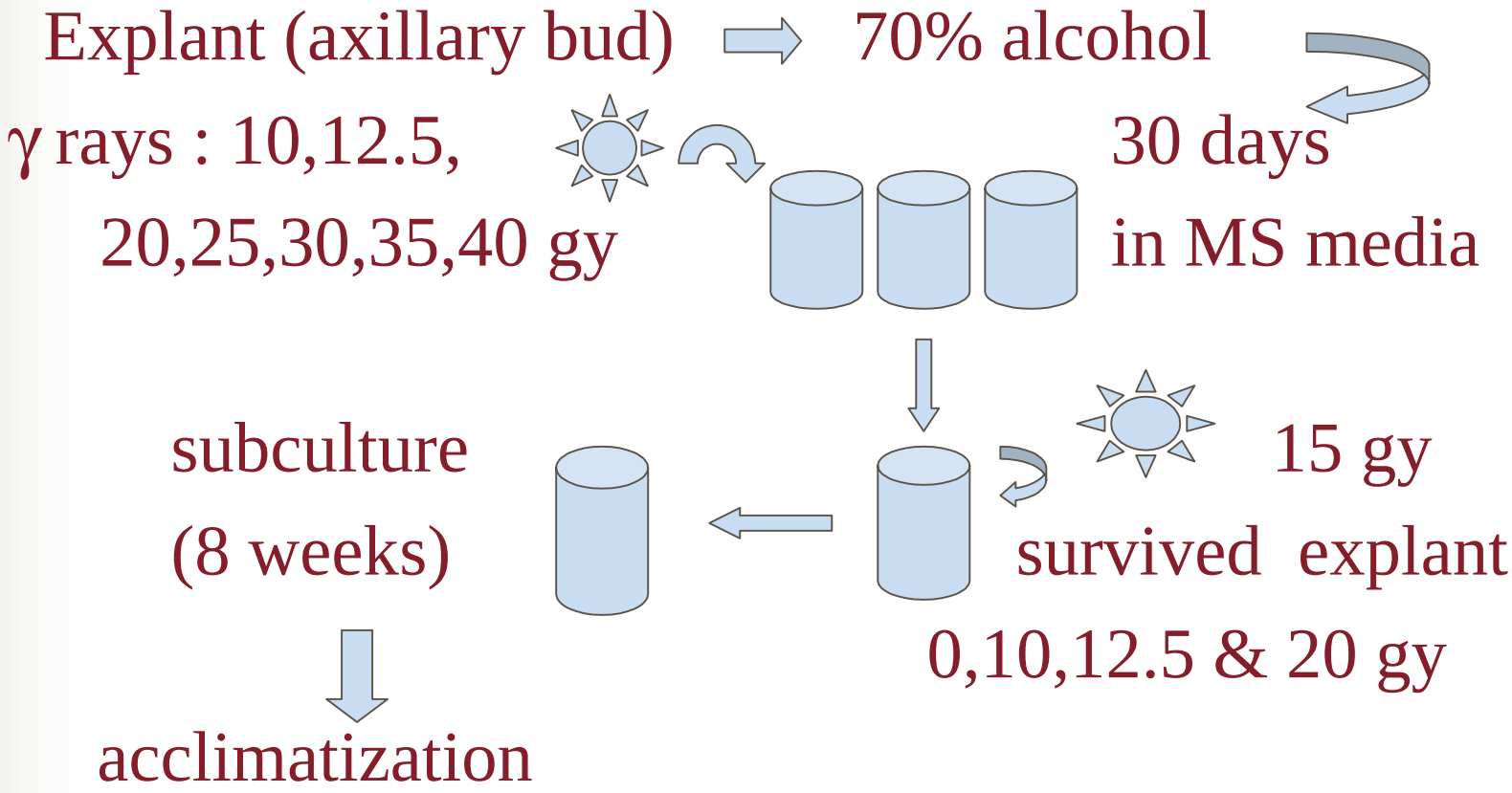
- Location : laboratory & green house at INLITHI Cipanas, West Java, Indonesia (1100 m above sea level)
- Seven local cultivars of chrysant :

  1.Sekartaji 2.Chandra kirana

  3.Saraswati 4.Dewi Sartika

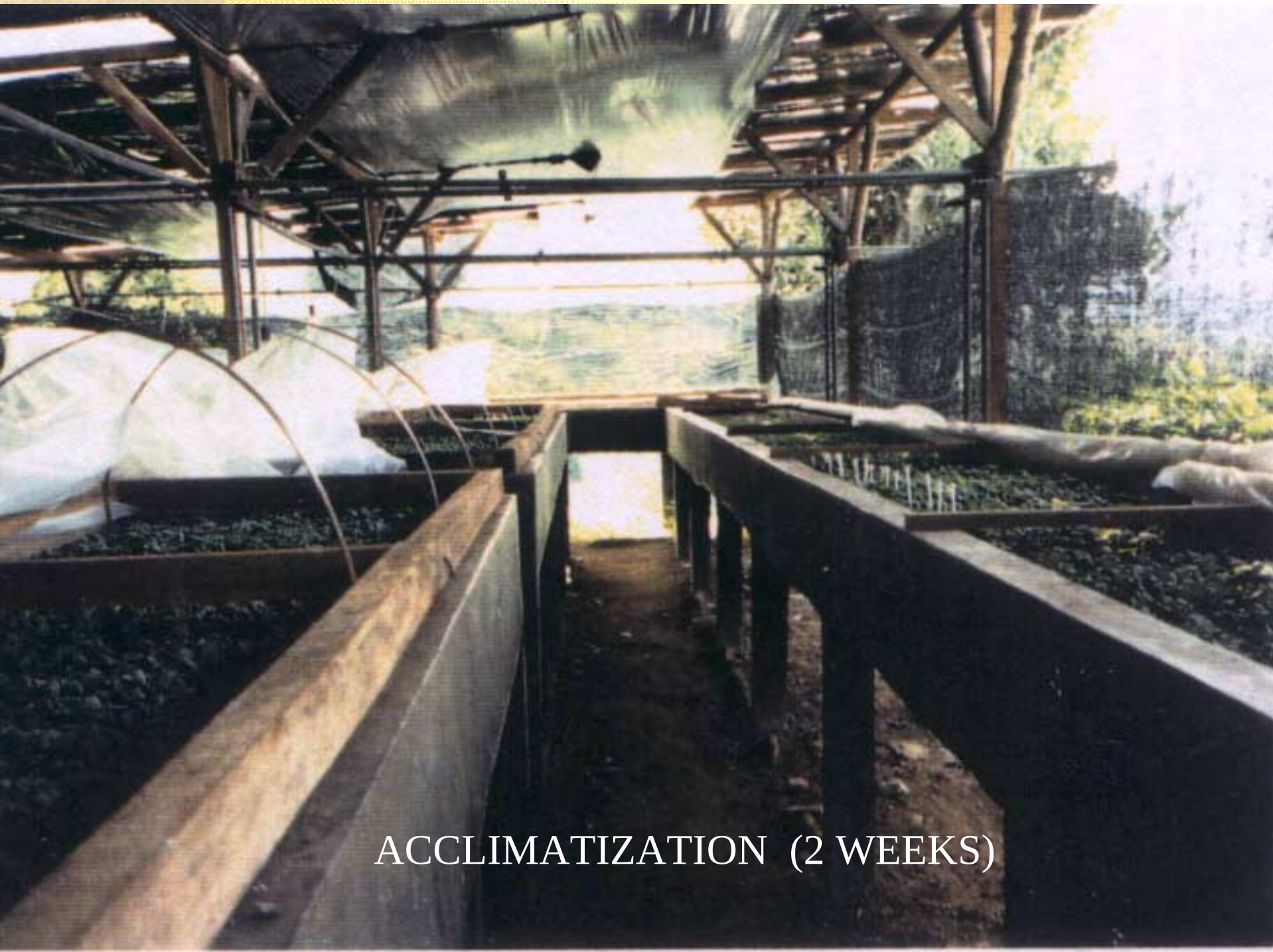
  5.Kartini 6.Larasati 7.Cut Nyak Dien

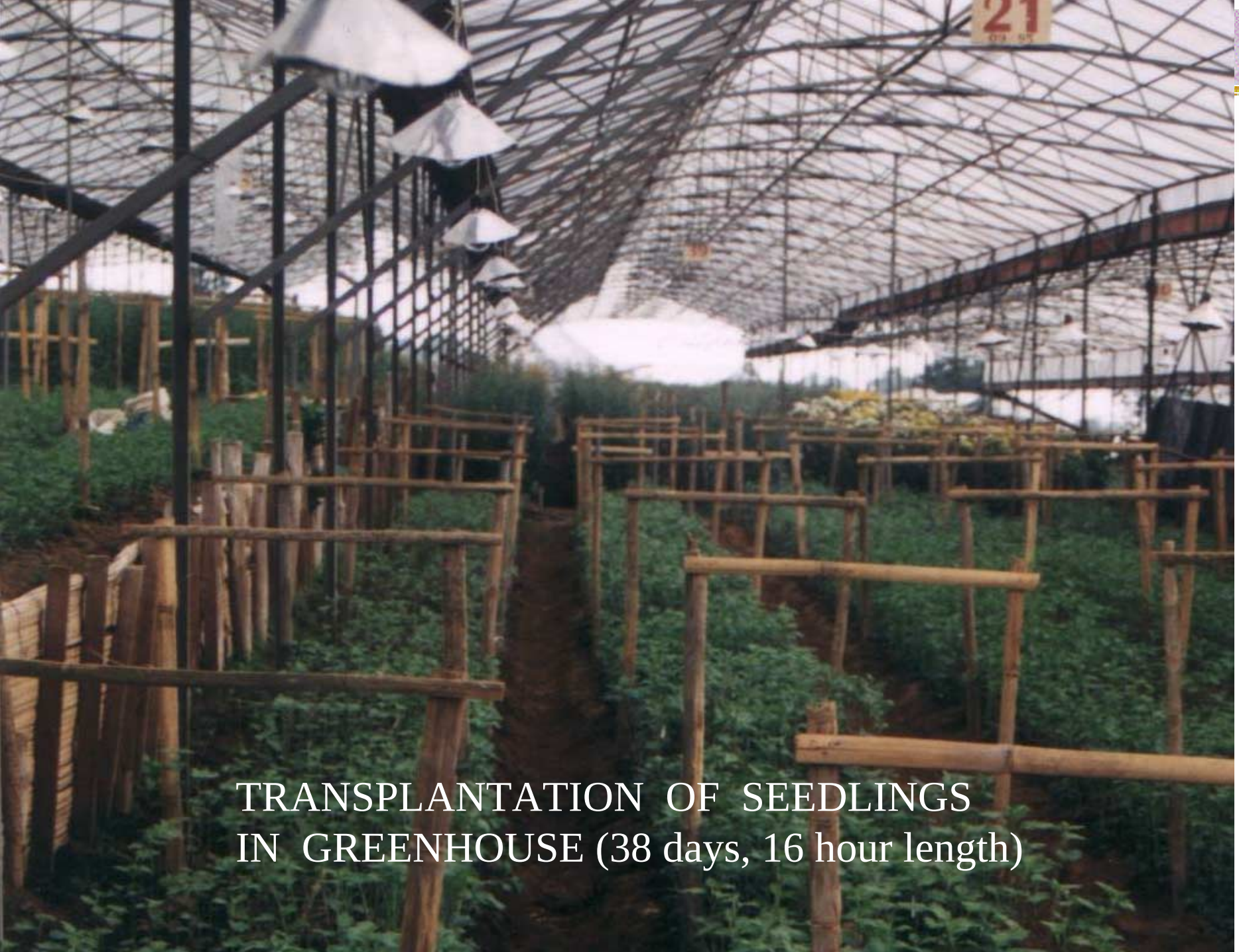
METHODS



Intermitten
After subcu

Intermittent
Irradiated plantlets
At INLITHI's laboratory


ACCLIMATIZATION (2 WEEKS)



TRANSPLANTATION OF SEEDLINGS
IN GREENHOUSE (38 days, 16 hour length)

Observation :

- Percentage of plant death
- Plant height (cm)
- Total internodes
- Leaf width (cm)
- Total flower
- Diameter of flower and petiole (cm)
- Distortion of vegetative & generative morphology

RESULT AND DISCUSSION

Dose rate (gy)	Saras wati	Seka taji	Cut nyak dien	Dewi sar-tika	Kar-tini	Ch. kira-na	Lara sati
0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
12.5	0	0	0	0	0	0	0
20	70	60	60	60	58.3	43.3	56
25	86.7	80	85	85	92.7	72.9	78.8
30	95.6	86.7	88.9	90	95	76	86.6
35	100	96.7	95	91.4	100	80	95
40	100	100	100	100	100	85	96

- Irradiated plantlet exhibited different response, depend on cultivars

- The growth on plantlet → until 12.5 gy → normal
  → start on 20 gy → lethal

- The death is related to cell/tissue damage, caused by the increase of dose rate :

  High dose rate ⇨ high energy to penetrate cells
  → destroying cells

- In *Alpinia purpurata*, 15 gy of γ rays → decrease the rate of survival (Fereol, 1996)

Equation of regression to determine LD_{50} on chrysant cultivars

Variety	Equation of regression	Dose rate (gy)
Saraswati	Y=3.20x-13.56	19.55
Sekartaji	Y=3.15x-15.03	20.63
Cut Nyak Dien	Y=3.16x-14.57	20.42
Dewi Sartika	Y=3.13x-14.23	20.50
Kartini	Y=3.28x-14.01	19.80
Chandra Kirana	Y=2.69x-13.44	23.55
Larasati	Y=3.08x-14.82	21.05

Observation in Green House

- The growth and development of irradiated plant in green house found inhibited
- The interaction between cv and dose rate was significant for :
  - vegetative : plant height, total internodes, leaf width
  - Generative : total flower, diameter of flower and diameter of petiole

- The height of irradiated plants tend to be lower than unirradiated plant (→ inhibition of apical meristematic cells)

- Inhibition was different from one cultivar to another :

  e.g. :

⇨ cv. Kartini, Larasati, Dewi Sartika & Chandra Kirana :

10 gy → reduce plant height

12.5 gy → increase plant height

20 gy → decrease plant height

⇨ cv. Saraswati, Sekartaji, Cut Nyak Dien :

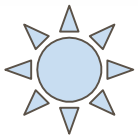
12.5 gy → reduce plant height

20 gy → increase plant height

For Total Internodes :

CULTIVAR	Dose rate (gy)	Total internodes
Sekartaji Dewi Sartika Kartini	Increase	Decrease
Saraswati Cut Nyak Dien Larasati	Increase	Increase

Kusumo (1989) :



irradiation

ionization

physiological disruption

shorten roots and
reduce total roots

absorption of soil nutrient will be reduced

Accumation of Photosynthesis Product is low ⟸ vegetative parameters of iradiated plants

⟹ generative parameters of iradiated plants

Distortion on vegetative morphology of chrysant

Ibrahim (2000) :

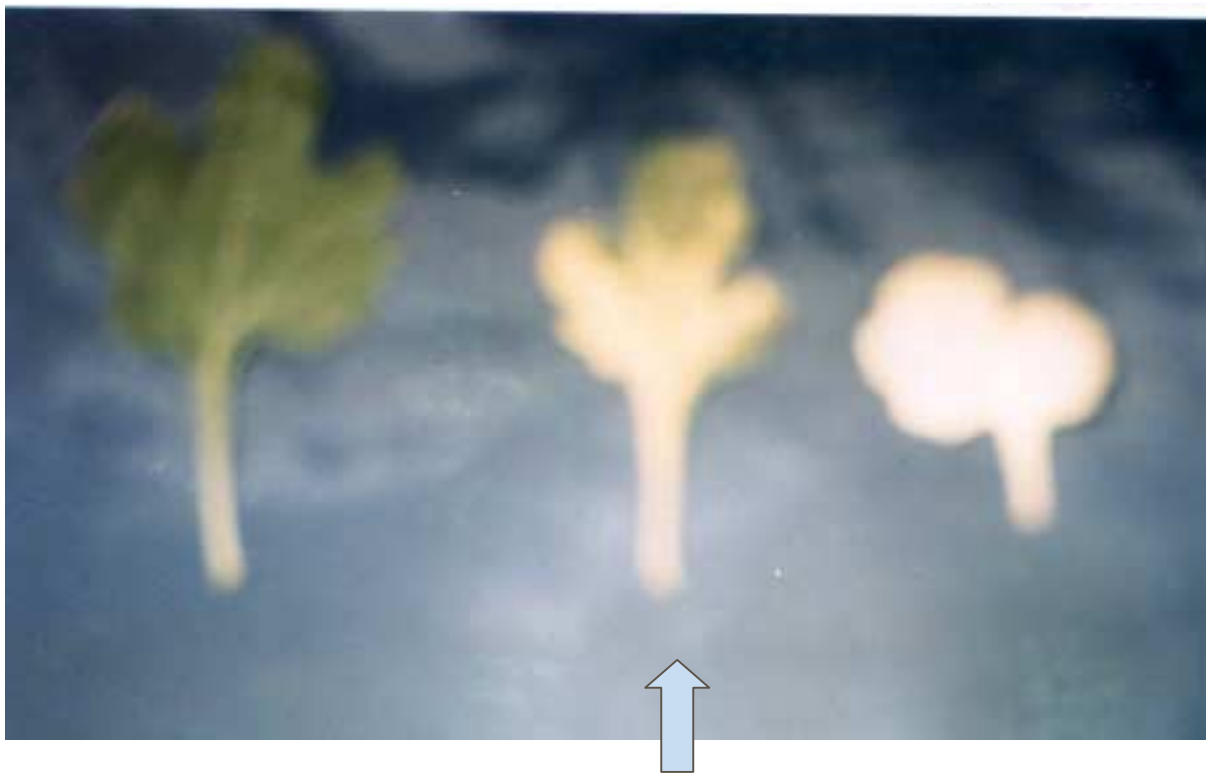
"Diplontic Selection"

Situation where mutated cells compete against normal cells

Succeed to establish:
Forming a tissue layer/
create a new form

not survived in competition :
mutated cells lost,
normal cells express again

(unstabile) variegated leaves → diplontic selection



Distortion on generative morphology of chrysant : changes of flower colour and shape

control mutant

- Saraswati : light yellow to dark yellow
- Kartini: dark red become yelowish red, decrease in diameter
- Dewi Sartika: purple to white pink spot, reduce in diameter
- Cut Nyak Dien: white to light yellow
- Chandra Kirana: white to yellow
- Kartini: dark red to yellow and orange (‘spoon like’ petals)

Davies & Kathy (1997) :

The main pigment controlling the colour of flower :

FLAVONOID	CAROTENOID	BETALAINS
Pink, red, purple, Blue and yellow	dark pink, red, and yellow	dark pink, red, purple & yellow

their proportion in plant

Influence the colour of flower

Ridwan et al. (1978) :

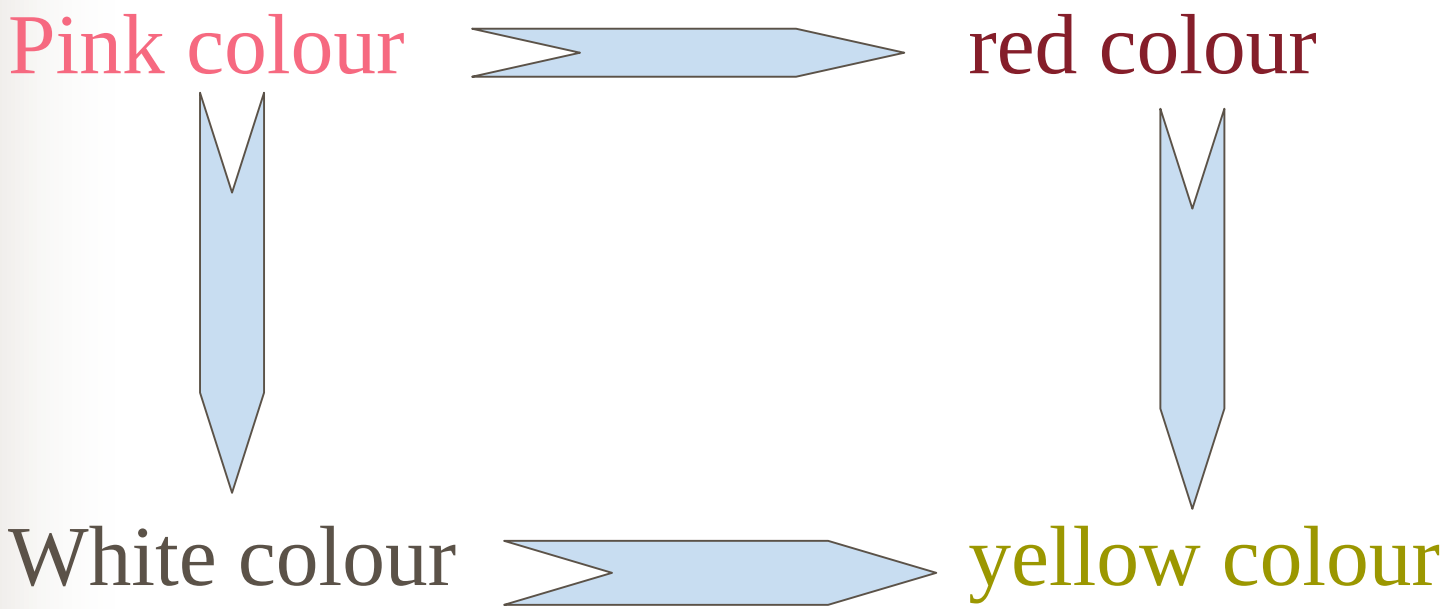
Radiation cause :

Molecular → biochemical → physiologycal → mutation in
Alteration damage effect organism

Change synthesis of flower pigment

change colour of flower

De Jong (1964) :



Yellow petals indicate the final colour, so that the opportunity to alter is limited

No yellow flower change, except cv. Saraswati, which change from light yellow to dark yellow (# 1)

Sekar taji

mutan (D_1)

kontrol

CONCLUSION

- Gamma irradiation inhibited and or altered the growth and development of chrysant
- Each variety gave different response to irradiation dose rate
- The range of LD_{50} for these seven cultivars is between 19.55 gray to 23.55 gray
- Amongst cultivars observed, cv.'Saraswati' and 'kartini'are the most intolerant cultivars to gamma rays
- Irradiation treatment created variability in colour and shape of flower
- Of eight irradiation doses, dose 10, 12.5 and 20 gray could induce the most frequent mutation
- This change indicated the genetic distortion caused by irradiation.


THANK YOU