Mutation Breeding in the Hyacinthaceae©

Sanette Thiart
In Vitro Gene Bank, ARC – Roodeplaat, Vegetable and Ornamental Plant Institute
E-mail: sthiart@arc.agric.za

INTRODUCTION

Evolution.

- Constant, natural phenomenon.
- Caused by cosmic or ultraviolet rays.
- Faulty DNA replication.
- Can be encouraged or accelerated where needed.

Crop Improvement. Agricultural crops today have all undergone improvement by means of:

1) Selecting the best plants.
2) Crossings to combine good qualities.
3) Resorting to other sources of variation when existing germplasm fails to provide the desired recombinant.
   - By means of mutation techniques.
   - In vitro techniques.
   - Molecular techniques.

MUTATION BREEDING

Background. Induced mutations are used extensively in floriculture, e.g., *Streptocarpus* where five commercial mutants were obtained in 3 years from one cultivar. It is used in a number of different crops, i.e., it is standard practice to irradiate new chrysanthemum cultivars.

Induced mutations are carried out in order to: Improve yields, improve quality, disease resistance, pest resistance, increase attractiveness of flowers, and increase attractiveness of ornamental plants

Food and Agriculture Organization/International Atomic Energy Agency (FAO/IAEA) Mutant Database. There are over 2,200 officially released mutant taxa including:

- 47% cereals
- 24% ornamental plants
- 14% legumes
- 4% industrial crops
- 3% vegetables
- 3% oil crops
- 5% other crops

What Happens in Mutation Breeding.

- It alters genes by exposing seed or plant parts to mutagens.
- It changes the DNA (the DNA sequence can be changed).
- Parts of the chromosomes can be rearranged.
- An entire chromosome can be lost or duplicated.

How Does It Work? It requires three things, i.e., plant material, mutagen, and method.

1) Material – Seed, leaves, growth tips, etc.
2) Mutagen – Chemicals or irradiation.
3) Method – Combination of the above.

Chemical Mutagens. These are rarely used in vegetatively propagated crops because they are not very successful. This is due to poor uptake of mutagen and poor penetration of chemical compound. It is also difficult to repeat. The explants differ.

Radiation. This is preferred because it is easy to apply. It is reproducible and gives high frequency mutations. The disadvantages are that the mutations occur at random. Progeny has to be evaluated and selection is needed

International Floriculture Market Requires:

- Development of products that will appeal to consumer taste.
- Production methods at competitive prices.
- Ongoing introduction of new varieties.
- Floriculture market is fashion orientated.
- Colour and growth form variation is very important, i.e., yellow is good for Easter, red and white for Christmas, and softer colours for Mother's Day.

The Bulb Mutation Technology Project

Project started in April 2003 and ended Sept. 2006. The project is funded by the Innovation Fund and makes use of existing knowledge. It uses irradiation to induce mutants. The prime objective is to get new flower colour. A consortium consisting of the following partners runs the above project:

- ARC – Roodeplaat — research.
- Rural integrated engineering — project management.
- Vosbol — some research and commercialization.

Why Hyacintheceae?

- Mutation is a one-cell event.
- They are vegetatively propagated.
- Adventitious buds form on the leaf tissue.
- It is from single-cell origin thus mutations should be solid.
- Non-chimeral mutants.

Bulbs Taxa Used in This Project:

- *Lachenalia* — Produced beautiful mutations; especially new colour forms.
- *Ornithogalum* — Produced no colour change but increased flower size; good for cut flower industry.
- *Eucomis* — Produced bigger plant with leaves densely spotted; usual bad scent remained.

Regeneration capacity. Once a good mutant is found, the grower must be able to propagate it easily. Some mutants loose some regeneration capacity. Some do not grow and have to be discontinued.

CONCLUSION

We have the technology and expertise to induce mutations. Specific methods for the Hyacinthaceae have been developed and can be adapted to other crops. Currently at least four new cultivars have been identified in the Hyacinthaceae for multiplication and further evaluation.