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Self–Incompatibility - A Boon for Plant Breeders in Hybrid Seed Production

Namrata Dwivedi*
Department of Genetics and Plant Breeding
Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior-474002, Madhya Pradesh

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*Corresponding Author
Namrata Dwivedi*
E-mail:
namratadwivedi1998@gmail.com

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INTRODUCTION

We know that in hybrid seed production our main concern is to stop self pollination within the strain getting used as female parent. Self-incompatibility and male sterility are the two main features, which easily exclude self-pollination, and are utilized in hybrid seed production.

Self-incompatibility was first reported by Koelreuter. It refers to the shortage of a plant with functional pollen to line seeds when self pollinated. It's the failure of pollen from a flower to fertilize an equivalent flower or other flowers of an equivalent plant and thus encourage out-crossing and allogamy. By this article I am going to explain about how self incompatibility encourages our modern plant breeder for hybrid seed production.

Reasons for Self-Incompatibility

1. Pollen stigma interaction.
2. Pollen tube and style interaction.
3. Pollen tube and ovary interaction.

Classifications of Self-Incompatibility

1. Heteromorphic self-incompatibility
2. Homomorphic self-incompatibility

Heteromorphic self-incompatibility

Flowers of different incompatibility group have different morphology especially for length of styles and stamens. It is of two types-

Distyly- here both stamens and styles are basically of two types. Stamens may be low and high and styles short and long. It is determine by a single gene, with two alleles. The flowers with short style and high stamen is named as thrum type and flower with long style and low stamen is named as pin type.

Flowers which belongs to single incompatible gene don't set seed once they are cross pollinated with one another i.e.

Pin flower is crossed with pin flower then no seed formation takes place.

But when pin flower is cross pollinated with thrum flower then seed formation takes place.

Eg. Buck wheat

1. **Tristyly-** Here, styles and stamens have three different position. It's determined by two genes S and M, each with two alleles. S gives rise to short style. S and M to medium style and hence s and m to long style.

Eg. Lythrum salicarea

Homomorphic self-incompatibility

Flowers that's of various incompatible group are of identical morphology. It's of two types.

1. **Gametophytic Self-incompatibility**- This was 1st described by east and Mangledorf in 1925 in tobacco. During this system, the incompatability reaction of pollen is decided by its own genotype and not by the genotype of the plant on which it's produced. Incompatibility is controlled by the only S allele within the haploid pollen grain. Thus, a pollen grain will grow in any pistil that doesn't contain an equivalent i.e

   S1S2*S1S2 = Fully incompatible
   S1S2*S1S3 = Partially compatible
   S1S2*S3S4 = Fully compatible

2. **Sporophytic self-incompatibility**- This was 1st reported by Hughes and Babcock in 1950 in crepis foetidae. During this system incompatibility reaction of pollen is governed by genotype of plant on which pollen is produced and not by genotype of pollen.

S2 pollen, which was produced by a S1S2 parent, cannot germinate on S1S3 stigma.

Temporary Supression of Self-Incompatibility- also referred to as pseudofertility. This can be done by using followong technique:

1. **Bud pollination**- This is often defined as pollination of immature bud with mature pollen.
2. **Surgical technique-** Removal of stigma for sporophytic system and removal of style for gametophytic system.
3. **Irradiation-** X-rays and gamma irradiation suppress self incompatibility reaction in gametophytic system.
4. **High temperature-** Providing Temperature upto 60 degree Celsius can supress SI reaction.
5. **High CO_2 concentration-** This system also can suppress SI reaction.

Elimination of Self-Incompatibility

1. **Doubling the chromosome number**– This system is effective in single locus gametophytic system.
2. **Isolation of self fertile mutants-** more successful in gametophytic system.
3. **Transfer of self compatibility alleles**

Temporary supression and elimination of self incompatibility is typically practice when a breeder is in need of promoting self pollination or inbreeding, otherwise for hybrid seed production a breeder should usually promote self incompatibility.

Significance of Self-Incompatibility

1. SI prevents self fertilization.
2. When inbreeding is desired, technique that temporarily suppress SI reaction have to be used.
3. SI is employed for hybrid seed production.

Problem In Use of Self-Incompatibility for Hybrid Seed Production

1. Production of inbred by hand pollination is expensive so, SI causes inbred variety production problem.
2. Environmental factor like high temperature and high humidity totally suppress SI reaction.
3. Bud pollination has got to be made to take care of the parental lines.
4. It is very difficult to provide homozygous inbred lines during a self incompatible species.

CONCLUSIONS

From above we conclude that self incompatibility is of great significance to plant breeders. This phenomenon is produce by plant itself so no physical involvement by the breeder is required but it's the responsibility of the breeder to take care of and promote this

phenomenon for hybrid seed production. Because today the demand of any variety directly or indirectly depends on the yield and this yield are often increased by the assembly of hybrid seeds. It's a crucial pollination control device which promotes allogamy. Self incompatibility system permits combining of desirable genes during a one genotype. Moreover knowledge of self incompatibility specially in fruit crops, helps fruit growers to increase the yield of fruits by providing suitable pollinators. Also, self incompatibility provides a way for hybrid seed production without emasculation and without restoring to GMS and CMS. It's been utilized for production of economic hybrids in brassica and sunflower. So, self incompatibility may be a promising phenomenon for the assembly of both field as well as horticultural crops and hence it's a boon for plant breeders.

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