

Cytogenetics for plant breeding

Course Objectives

- To study principles of genetics, biology and technology for plant selection and breeding
- To gain an understanding and appreciation of the importance of plant germplasm for plant breeding
- To study and practice plant hybridization techniques
- To develop an understanding of plant breeding techniques and methodology appropriated for horticultural crops

Course Description

Principles of cytogenetics. Breeding for varietal improvement of horticultural crops. Techniques in selection and breeding for improvement of horticultural crops. Doubled haploid in breeding, Interspecific hybridization and introgression, How to keep heterosis: apomixis and reverse breeding, Unreduced gametes and applications, Creation and application of immortal lines, Chromosomes and genomics, including FISH technology.

Week	Date	Time	Content	Instructor
1	Tue 16 Aug 16	10.00-12.00	Class orientation	Hans de Jong, Julapark, Ratri
2	Tue 23 Aug 16	10.00-12.00	Basic knowledge of chromosome biology	Hans de Jong
3	Tue 30 Aug 16	10.00-12.00	Essentials of mitosis and meiosis	Hans de Jong
4	Tue 6 Sep 16	10.00-12.00	Genetic recombination (mutation – transposon – meiotic recombination)	Hans de Jong
5	Tue 13 Sep 16	10.00-12.00	Haploidy – polyploidy – aneuploidy – endopolyploidy	Hans de Jong
6	Tue 20 Sep 16	10.00-12.00	Translocations – inversions – deletions	Hans de Jong
8	Tue 4 Oct 16	10.00-12.00	CenH3 induced haploids – Doubled haploid in breeding	Hans de Jong
9	Tue 11 Oct 16	10.00-12.00	Interspecific hybridization and introgression	Hans de Jong
10	Tue 18 Oct 16	10.00-12.00	How to keep heterosis: apomixis and reverse breeding	Hans de Jong
11	Tue 25 Oct 16	10.00-12.00	Unreduced gametes and applications	Hans de Jong
12	Tue 1 Nov 16	10.00-12.00	Creation and application of immortal lines	Hans de Jong

13	Tue 8 Nov 16	10.00-12.00	Chromosomes and genomics, including FISH technology	Hans de Jong
14	Tue 15 Nov 16	10.00-12.00	Presentation II	Hans de Jong
15	Tue 22 Nov 16	10.00-12.00	Discussion	Hans de Jong

Lecture

Learning goals basic topics

1. Basic knowledge of chromosome biology (2 hr)
2. Essentials of mitosis and meiosis (2 hr)
3. Genetic recombination (mutation – transposon – meiotic recombination) (2 hr)
4. Haploidy – polyploidy – aneuploidy – endopolyploidy (2 hr)
5. Translocations – inversions – deletions (2 hr)

Advanced topics

1. CenH3 induced haploids – Doubled haploid in breeding (2 hr)
2. Interspecific hybridization and introgression (2 hr)
3. How to keep heterosis: apomixis and reverse breeding (2 hr)
4. Unreduced gametes and applications (2 hr)
5. Creation and application of immortal lines (2 hr)
6. Chromosomes and genomics, including FISH technology (2 hr)

Literature

1. Four papers will be selected and students work in small groups to prepare
 - a. One group with PowerPoint presentation (Home work, 2 hr)
 - b. One group making the questions (Home work, 2 hr)
 - c. All students participate in the discussions (Plenary, 2 hr)

Lab classes

1. Squashing method for making fresh chromosome slides of root tip meristems, eventually with effect spindle inhibitor. (Laboratory with microscopes, 4 hr)
2. Slides of meiotic chromosome spreads of grasshopper (same as D.1., but also possible to work with permanent slides) (Laboratory with microscopes, 4 hr)
3. Meiosis of a tetraploid plant (*Tradescantia virginiana*).

Permanent slides available (Microscopes, 4 hr)

4. Meiosis of a translocation heterozygote of rye.

Permanent slides or photos available (Microscopes, 2 hr)