

Towards the construction of chromosome maps in *Lilium* based on recombination points analyzed with GISH

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Introduction: Longiflorum, Asiatic and Oriental lilies belong to the section Leucolirion, Sinomartagon and Archelirion in the genus *Lilium* respectively. Both LA and OA hybrids are very promising in lily breeding for different agronomical traits. $2n$ gametes producing LA and OA hybrids have been used to develop the following progenies in a BC breeding program. Genomic *in situ* hybridization (GISH) could discriminate the parental chromosomes of these hybrids. In this research, we obtained BC1 progenies and plants from each population were analyzed with GISH. Based on GISH recombination mapping has been done on three genomes of *Lilium*.

Results: 1. GISH analysis on BC1 LAA hybrids confirm that F1 LA hybrids can produce functional n (Fig. 1-A) and $2n$ gametes (Fig. 1-B). These result in to the formation of diploid and triploid BC1 progenies respectively. Such diploid BC1 progenies were found for the first time in lily. This may open a new way for lily introgression breeding without increasing the ploidy level of following generations.

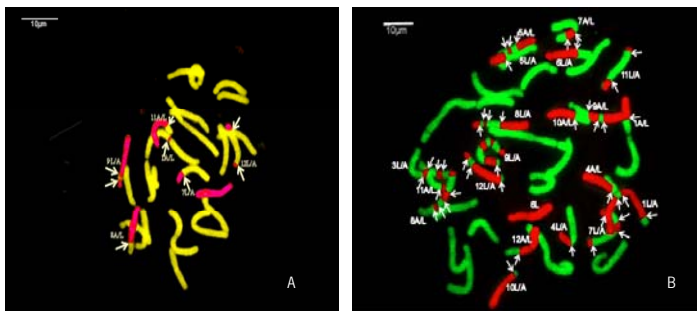


Fig. 1. (A) Diploid BC1 LA hybrid indicating the normal meiosis and production of functional haploid gametes in F1 LA hybrid (B) Triploid BC1 LA hybrid showing functional $2n$ gametes from F1 LA hybrid

2. Most of BC1 OA hybrids are triploid confirming F1 OA hybrids produced $2n$ pollens (Fig. 2-C) except one tetraploid (Fig. 2-D). The resultant triploid progenies can produce *functional haploid gametes*. In triploid progenies, the variation caused by chromosome substitution and intergenomic recombination are important for selection.

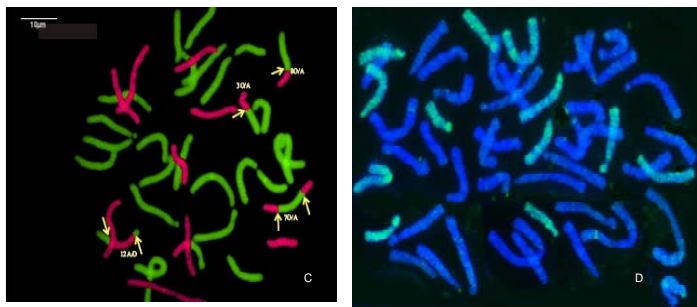


Fig. 2 (C) BC1 triploid OA hybrid with functional $2n$ gametes (D) BC1 tetraploid OA hybrids with functional $2n$ gametes from both parents

3. In recombination mapping the break points on each chromosome are used as markers (Fig. 3). These data provide critical estimates of the recombination frequencies, recombinant point and recombination hotspots amongst the three genomes of lily. Comparison of the recombination map of different genomes shows the interrelationship of recombination from one chromosome to another and also from one part of the chromosome to another on the same chromosome.

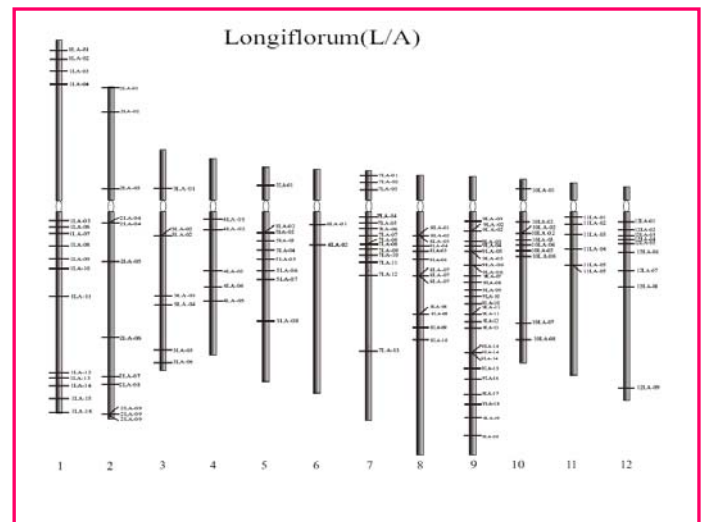


Fig. 3 Recombination map of Longiflorum (L/A) based on breaking points analysed by GISH

Conclusions

- F1 LA hybrids produce both functional haploid and diploid gametes leading to BC1 diploid and triploid progenies respectively.
- The variation caused by chromosome substitution and intergenomic recombination is important for selection in triploid BC1 OA hybrids.
- Recombination mapping based on GISH provides critical information about the recombination frequencies and recombination hot spots in three genomes of lily.