

## **Cloning of plant QTLs: results, challenges and perspective**

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Recent technical progress in the area of molecular biology and genomics have made possible the molecular dissection of major loci (Quantitative Trait Loci: QTLs) responsible for the genetic control of quantitative traits. Most plant QTLs have been cloned through a positional cloning approach after their identification in experimental crosses. So far, positional cloning has been limited exclusively to major QTLs that account for a sizeable portion (> 15-20%) of the phenotypic variation reported in the primary genetic analysis. In this case, the rather long time required for the isogenization of the QTL after its discovery can be conveniently avoided if QTL discovery is carried out through the evaluation of an introgression library of near isogenic lines obtained by backcrossing and that cover the entire genome. The most interesting cases of QTL cloning will be reviewed, particularly when the QTL has been assigned to an apparently non-coding region. In some cases an association mapping approach has allowed for the identification of an association between sequence variation at a candidate gene and a phenotype by the analysis of existing genetic accessions characterized by low linkage disequilibrium. Several refinements of these strategies are made possible by deploying appropriate genetic materials and the latest developments in genomics platforms (e.g. transcriptomics) which allow us to identify eQTLs (expression QTLs), i.e. functional polymorphisms influencing the level of expression of a particular gene. A strategy based on reverse genetics could also be deployed to clone QTLs. We foresee that while QTL analysis and cloning addressing naturally occurring genetic variation will shed light on mechanisms of plant adaptation, more emphasis on approaches relying on candidate gene identification and mutagenesis will accelerate the pace of discovery of the genes underlining QTLs. Although QTL cloning is still in its infancy, further refinement of genomics tools and platforms will make QTL cloning a more routine procedure in crops.