In order to identify the genes controlling developmental traits and abiotic stress tolerance in tomato, our laboratory is performing an insertion mutagenesis program, in collaboration with the groups of Dr. Rafael Lozano (Almería University) and Dr. Mª Carmen Bolarín (CEBAS-Murcia). This PhD thesis is part of our insertion mutagenesis program and aims to keep deepening in the genetic dissection of relevant traits from an agronomic perspective using the generation and characterization of tomato T-DNA lines.

With the goal of increasing the collection of tomato T-DNA lines previously generated in our group, we generated 974 new T-DNA lines. This collection of tomato T-DNA lines was evaluated in the greenhouse in order to detect dominant or semi-dominant mutants altered in vegetative and/or reproductive traits. In particular we paid special attention to mutants with changes in fruit set, since the altered genes in those mutants could play a role in the yield of tomato cultivars.

The transition from ovary to a developing fruit (i.e. fruit set), occurs once the flower has reached the anthesis stage, and depends on the pollination and fecundation. However, the fruit development can also happen independently of pollination through a process named parthenocarpy. It is known that the growth regulators, mainly auxins and gibberellins, are involved in both kinds of fruit set processes. Even so, the genetic mechanisms that trigger the transition from ovary to fruit remain largely unknown. Accordingly, tomato mutants can be a valuable tool to shed light on the molecular and genetic basis that promote pollination-dependent or independent fruit set processes.

Given the enormous interest raised by parthenocarpy, the work carried out in the context of this PhD thesis has been mainly focused on several seedless fruits mutants. The characterization of those mutants revealed alterations in vegetative plant development (e.g. leaf architecture) and/or reproductive development (e.g. fruit morphology) have been observed, suggesting that changes in endogenous levels of growth regulators (e.g. auxins and gibberellins) are closely related to the
parthenocarpic fruit development. According to the histological analysis, most of the mutants showed cytological androsterility, and part of them also displayed deficiencies during the pollen sacs formation, a trait also related to parthenocarpic fruit development. Furthermore, it has been observed an increased fruit set rate in some parthenocarpic mutants leading to a higher fruit production per plant. Some mutants displayed a tight correlation between the alteration in floral whorls or fruit tissues and the expression of the GUS reporter gene included in the T-DNA, suggesting that the gene responsible of the mutant phenotype could be tagged by a T-DNA insert. Finally, the phenotypic, genetic and molecular characterization of the back-cross progeny of the Tom24 mutant suggests that this phenotype could be a consequence of a T-DNA insert which is not transmitted to the offspring due to a lethal effect in both types of gametes (♂ y ♀).