ABSTRACT

The development of commercial cultivars of tomatoes has taken place in recent times, aided by an increasing knowledge of its genetic base. However, these modern cultivars generally do not meet the organoleptic expectations of consumers, since the improvement objectives that have guided their development have not included a character as complex as the organoleptic quality. The growing disappointment of consumers with this aspect and their demand for tastier tomatoes has increased the interest in studying the factors that condition this complex character in order to be able to tackle it effectively in breeding programs. The present thesis aims to contribute to the approach of this breeding objective from the point of view of the use of the natural variability present in the genus *Solanum* section *Lycopersicon* to increase the content in compounds involved in the perception by the taste.

To do this, it was initially necessary to develop a methodology enabling a precise analysis of the large number of samples that are usually handled in a breeding program. Thus, a capillary zone electrophoresis method has been developed for tomato samples and related species, allowing simultaneous quantification of organic acids such as oxalic, malic and citric, and sugars such as glucose, fructose and sucrose, which determine the taste of tomato, with detection limits lower than 2 and 25 $\mu g\ ml^{-1}$ respectively. Its high automation of the series of analysis and reproducibility, as well as its simple sample preparation, running time of less than 20 minutes and a low execution cost, have made it possible to apply it in a generalized way in tests of evaluation of organoleptic quality characteristics in tomato germplasm.

The next step has been to evaluate germplasm considering taste-related compounds to detect sources of variability potentially useful. The materials studied have been accessions and landraces of cultivated tomato from different origins, as well as wild accessions and accessions from wild species (*Solanum lycopersicum*, *S. pimpinellifolium*, *S. habrochaites*, *S. pennellii* and *S. peruvianum*). The results allow to conclude that, in some cases, among the collected materials there is great variability and very high contents in compounds responsible for tomato taste. Accessions from the *Lycopersicon* group, including the phylogenetically closest wild species to the crop, have been identified with nearly triple the content of sugars and malic acid and double that of citric acid of that of the commercial varieties used as controls. The genetic proximity of these materials will facilitate its use in breeding programs of the organoleptic quality targeted to balanced improvement of taste. Although more phylogenetically distant, two accessions of *S. habrochaites* from the *Eriopersicon* group have been identified with malic and citric acid contents seven and nine times greater than the best controls, which may be useful when looking for materials with shades of acidic taste.

Finally, since the effect of the environment can significantly influence the accumulation of compounds responsible for tomato taste, not only directly, but also by uncovering specific genetic effects due to the interaction of the genotype with the growing environment, we have developed a multi-environment study as a tool for extensive and accurate evaluation of the actual genetic potential of various accessions for improving

tomato taste. In this study, clonal replicates of the same genotypes were evaluated in three different environments to more accurately estimate the contribution of the environment, genotype and genotype x environment interaction in the accumulation of taste-related compounds. The effect of the environment has been studied considering the contribution to the accumulation of these compounds of the photosynthetically active radiation (PAR) and temperature throughout the study period, observing that the radiation affects to a greater extent the content in sugars and the temperature to acid accumulation. From the predictions of genotypic contribution and genotype x environment interaction, two accessions have been identified, one from *S. habrocahites* and another from *S. pimipinellifolium*, which may be interesting as sources of variability to increase taste with acid nuance due to its high content of malic and citric acids and their stability in the accumulation of these compounds. The identification of materials with different profile of citric, malic and glutamic acid accumulation will also be useful in the study of the regulation of tricarboxylic acid and GABA shunt cycles. On the other hand, the need to evaluate a large number of plants has been shown to take advantage of intra-population variation.