
SUMMARY

Fruits and vegetables contain bioactive compounds beneficial for human health. The development of varieties with a higher content in these compounds is of interest, as it contributes to satisfying an increasing demand by consumers of products with functional activity. Among other vegetables, eggplant (*Solanum melongena*) has a high antioxidant activity, mostly derived from its high content in polyphenols, and it has been demonstrated to have beneficial effects for human health. Amongst the phenolic compounds of eggplant, chlorogenic acid outstands, as it is the most abundant phenolic compound in this crop and presents multiple beneficial properties for health.

This Doctoral Thesis deals with the characterization and breeding of eggplant in order to obtain relevant information and plant material for the development of eggplant varieties with a higher content in bioactive compounds, in particular, polyphenols, making use of the intraspecific and interspecific variation. On the other hand, an integral breeding approach must take into account not only the trait to be improved, but also those traits of interest for the success of a variety and, in consequence, we have studied other traits related to the increase in the phenolic content, like fruit browning, and also other traits of general interest for breeding.

In the first part of this Doctoral Thesis we focus on the study of the diversity of common eggplant and related species in traits of agronomic interest. The objective is to evaluate the diversity, identify sources of variation and to study relationships among traits. In a first study, we evaluate a collection of traditional eggplant varieties, in which we have found a high diversity for functional quality traits and browning. In this study we found that the content in chlorogenic acid is positively correlated with the antioxidant activity and the correlation with browning is low, demonstrating that it is feasible to select eggplant varieties with high content in chlorogenic acid and moderate browning. We also found that, even with a low polyphenol oxidase activity, there may be a significant browning, suggesting that polyphenol oxidase activity (PPO) is not the limiting factor for browning in the studied collection.

With the aim of increasing the genetic diversity for breeding eggplant for bioactive compounds and other traits of importance, we have studied the

diversity in a collection of scarlet (*S. aethiopicum*) and gboma (*S. macrocarpon*) eggplants. The morphological characterization with conventional descriptors and phenomic tools (Tomato Analyzer) has allowed us to study the relationships among the different cultivar groups and wild relatives and to determine that scarlet and gboma eggplant complexes are hypervariable. In this collection we have also studied the reducing capacity and the content in chlorogenic acid, and we have found a huge variability. In general, scarlet eggplant presents relatively low contents, while gboma eggplant, in particular its wild ancestor *S. dasyphyllum*, presents very high values. In macrophage cell cultures we have also found that the varieties with higher content in chlorogenic acid also display a greater inhibition of nitric oxide (NO) production indicating beneficial properties for health.

In the second part of this Doctoral Thesis we have evaluated the interest of interspecific hybridization for eggplant breeding, in particular for the content in bioactive compounds. We have obtained two families, including backcrosses, between common eggplant (*S. melongena*) on one side and cultivated scarlet eggplant (*S. aethiopicum*) and the wild relative *S. incanum* on the other. The results show that fertility of materials derived from the hybridization between *S. melongena* and *S. aethiopicum* is low and that there is a low efficiency in the backcrosses to *S. melongena*. In addition, the low content in polyphenols of *S. aethiopicum* is dominant. On the contrary, the backcross to *S. aethiopicum* results in many plants with higher levels of fertility. Therefore, we suggest that *S. melongena* may be a source of variation for the improvement of the content in polyphenols of scarlet eggplant.

The family obtained by interspecific hybridization between *S. melongena* and *S. incanum* displayed high levels of fertility and, in the first backcross to *S. melongena*, we found individuals morphologically similar to cultivated eggplant. The study of phenolic compounds revealed that *S. incanum* is a good source of variation for the improvement of common eggplant, with values much higher than those of the cultivated species. In the first backcross we already found individuals with high chlorogenic acid content and moderate browning, suggesting that it is possible to successfully introgress the high content in chlorogenic acid of *S. incanum* in the genetic background of cultivated eggplant.

In summary, the works performed in this Doctoral Thesis contribute to new knowledge on the diversity and relationship among traits involved in functional quality of eggplant and other traits of interest for the genetic improvement of this crop. The materials selected and obtained are of great interest for the development of commercial varieties of eggplant with improved bioactive properties.