

Proceedings

Study of the Phenolic Content and the Antioxidant Capacity of *Rubus idaeus* L. Genotypes within the Development of a National Cultivar [†]

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Abstract: The production of raspberries in Portugal has increased considerably in the last two decades, assuming a great economic interest today. Here, we studied the phenolic content and the antioxidant capacity of selected genotypes within a breeding program. The results suggest that this program may be unintentionally selecting raspberry phenolics. If so, this would be of particular interest, since there is scientific evidence that raspberry phenolics or their metabolites may have beneficial health effects, namely antioxidant activity.

Keywords: red raspberry; genotypes; cultivar selection; total phenols; antioxidant capacity



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1. Introduction

Raspberry production in Portugal is currently of great economic interest, offering sustenance for small and large farmers. In 2018, the Instituto Nacional de Investigação Agrária e Veterinária, in close partnership with Beira Baga, an enterprise that produces and commercializes small fruits, started a small breeding program in order to release raspberry cultivars for all growers. This is particularly important when all raspberry cultivars are only released for exclusive or club growers. This study aims to investigate if the *Rubus idaeus* L. genotypes selected within the program by their agronomic and commercial quality parameters are also more abundant in phenolic compounds and have a higher antioxidant capacity.

2. Materials and Methods

The plants were installed in May 2019 at the Fataca Innovation Pole in Odemira, Portugal (planted in 36-l Styrofoam containers at a density of 3 plants per linear meter over tunnels covered in polyethylene plastic) (Figure 1a). All genotypes were fruitful in the first year of release in the fall. Production was recorded, and an empirical and expeditious survey of some of the most relevant quality characteristics of the fruit fresh and after 7 days stored at 4 °C, such as size, color/brightness and texture (Figure 1b). After this period, the genotypes best positioned in the hierarchy were selected. The laboratory work was carried out on samples of 12 genotypes, 9 red and 3 yellow raspberries (RRG and YRG), and 4 cultivars (Cv) of *Rubus idaeus* L. All samples were analyzed for their brix degree (NP EN 12143) and humidity content (Organization for Cooperation and Development method) [1]. A raspberry extract rich in phenolic compounds (extract solution composition—methanol:water:formic acid, 79.9:20:0.1 %v/v) [1] was made for 6 selected genotypes, 5 red

and 1 yellow raspberries (RRG and YRG), and 4 cultivars (Cv) of *Rubus idaeus* L. in triplicate. Then, the extract content of the total phenols (TP) was determined by Folin–Ciocalteu [1], and their in vitro antioxidant capacity was measured by the Ferric-Reducing Antioxidant Power (FRAP) method [2].



Figure 1. Aspects of the plants' installation at Fataca Innovation Pole in Odemira, Portugal (a); quality evaluation aspects of fresh *Rubus idaeus* L. in the field for selection (b).

3. Results and Discussion

Generally, breeding programs aim to optimize plants and fruits for certain production systems, mainly based on parameters such as yield, capacity to resist pests and diseases, quality attributes such as the taste and texture of fruits or their ability to maintain their quality postharvest, among others. The phytochemical composition of raspberries is not currently a selection parameter. However, that composition depends on the genotype, among others factors.

This preliminary study evaluated aspects of the quality and composition and phytochemical activity of fruits of selected genotypes and cultivars, the latter for comparison purposes. The humidity and brix degrees obtained for all the samples varied, respectively, between 88.3% and 90.7% and 5.5° and 9.8°. The TP and FRAP contents (mg gallic acid eq. and Trolox eq. μ moles/100 g fresh fruit, respectively) of the selected samples were among 96.2–124.1 and 722.5–1011.1 (RRG), 104.7 and 899.3 (YRG) and 151.4–202.3 and 1113.6–1436.2 (Cv). The results of all the samples were within the values published for raspberries [1,3]. The findings obtained here seem to support the investigation question, as the four RRG selected in 2020 had higher TP contents than the rejected one. However, all Cv had higher TP and FRAP values. It is interesting to note that the selection made seemed to also take into consideration raspberry phenolics. These constituents are largely responsible for their antioxidant capacity and, according to scientific evidence, can also contribute to other beneficial health effects.

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References

1. Correia, M. Caracterização Química e Avaliação da Atividade Biológica da Framboesa (*Rubus idaeus* L.): Contribuição para o Desenvolvimento de Uma Alegação de Saúde. Ph.D. Thesis, Universidade de Lisboa, Lisboa, Portugal, 2016.
2. Thaipong, K.; Boonprakoba, U.; Crosby, K.; Cisneros-Zevallos, L.; Byrnes, D.H. Comparison of ABTS, DPPH, FRAP, and ORAC assays for estimating antioxidant activity from guava fruit extracts. *J. Food Compos. Anal.* **2006**, *19*, 669–675. [[CrossRef](#)]
3. García, A.V.; Pérez, S.E.M.; Butsko, M.; Moya, M.S.P.; Sanahuja, A.B. Authentication of “Adelita” Raspberry Cultivar Based on Physical Properties, Antioxidant Activity and Volatile Profile. *Antioxidants* **2020**, *9*, 593. [[CrossRef](#)] [[PubMed](#)]