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SEED COAT COLOUR AS A DRIVER OF ANTIOXIDANT AND MORPHOLOGICAL VARIATION IN PORTUGUESE COMMON BEAN GERMPLASM

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Legumes play a critical role in sustainable food systems, yet many traditional varieties remain underutilised. In Portugal, despite the wide diversity of *Phaseolus vulgaris* L. landraces preserved in germplasm collections, consumer demand is largely restricted to a few commercial varieties, contributing to the loss of local genetic resources. To address this gap, a Portuguese common bean collection comprising 259 accessions, was evaluated with a focus on seed coat colour (light, dark, and mix). Morphological descriptors (seed weight and width), seed mineral (calcium, potassium, magnesium, iron, zinc and phosphate), protein content, starch, and bioactive compounds (phenolics, condensed tannins, DPPH, saponins, phytic acid) composition were quantified. Seed coat colour significantly affected antioxidant related traits. Dark seeds exhibited the highest phenolic content (1.05±0.35 mg GAE/g DW), condensed tannins (0.95±0.38 mg CE/g DW), and DPPH activity (5.36±1.72 µmol TE/g DW), all significantly greater than light seeds (phenolics 0.69±0.28 mg GAE/g DW; tannins 0.39±0.43 mg CE/g DW; DPPH 2.85±4.15 µmol TE/g DW). Mix coloured seeds showed significantly larger seed weight (53.18±13.96 g/100 seeds) and width (6.51±0.77 mm), reflecting distinct morphological clustering pattern. In contrast, minerals, protein and starch did not differ across colours. Correlation analysis confirmed that Dark seeds aligned with antioxidant traits (DPPH r=0.59 and phenolics r=0.47, P-value<0.05), while Mix seeds aligned with seed size. Overall, seed coat colour is a reliable visual indicator of antioxidant potential, offering an immediate and low cost criterion to identify nutritionally superior Portuguese landraces and broaden consumer and breeding choices beyond the narrow range of currently marketed varieties.

Keywords: antiradical capacity, germplasm characterisation, nutritional profiling, phytochemical diversity