

# Microstructural and lignin characteristics in herbaceous peony cultivars with different stem strengths

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Postharvest Biology and Technology, Volume 159, January 2020, 111043

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## Abstract

Straight stems are highly important to herbaceous peony (*Paeonia lactiflora* Pall.) cut flowers. To clarify whether the microstructural and lignin characteristics are associated with *P. lactiflora* stem mechanical strength, eight cultivars were used to study their anatomical structure, secondary cell wall, lignin deposition, lignin content and structure, lignin biosynthetic enzyme activity and related gene expression levels. The results showed that stem diameter was a direct indicator estimating its mechanical strength. Simultaneously, the number of vascular bundles, area of vascular bundles, number of duct perforations, ratio of xylem to cross-section and thickness of secondary cell wall had significant positive correlations with stem mechanical strength. Moreover, three lignin monomers were all detected in the stem, and the contents of S-lignin, G-lignin and total lignin in high stem mechanical strength cultivars were higher than those in low stem mechanical strength cultivars as a whole, and lignin was deposited in the cell walls of the sclerenchyma, vascular bundle sheath and duct. Additionally, cinnamate 4-hydroxylase (C4H), cinnamyl alcohol dehydrogenase (CAD) and polyphenol oxidase (PPO) activities in high stem mechanical strength cultivars were higher than those in low stem mechanical strength cultivars as a whole, and CAD might be the key gene among detected lignin biosynthetic genes. Consequently, microstructural and lignin characteristics were closely correlated with stem mechanical strength in *P. lactiflora*. These results would provide useful information concerning the physiological mechanism of stem strength.