

# Accepted Manuscript

Title: The Contents of Terpene Trilactone and Flavonoid in Leaves of Seedlings From Ancient Female Ginkgo Trees in China

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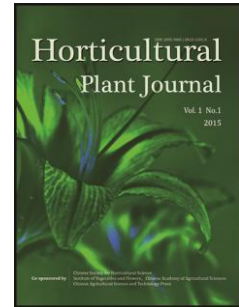
PII: S2468-0141(17)30144-9  
DOI: <http://dx.doi.org/doi: 10.1016/j.hpj.2017.06.002>  
Reference: HPJ 55

To appear in: *Horticultural Plant Journal*

Received date: 22-10-2016  
Revised date: 10-12-2016  
Accepted date: 2-1-2017

Please cite this article as: Zhang Yanhui, Liu Peiying, Kong Qianqian, Xing Shiyan, Liu Xiaojing, Sun Limin, The Contents of Terpene Trilactone and Flavonoid in Leaves of Seedlings From Ancient Female Ginkgo Trees in China, *Horticultural Plant Journal* (2017), <http://dx.doi.org/doi: 10.1016/j.hpj.2017.06.002>.

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# The Contents of Terpene Trilactone and Flavonoid in Leaves of Seedlings from Ancient Female Ginkgo Trees in China

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Received 22 October 2016; Received in revised form 10 December 2016; Accepted 2 January 2017

## Abstract

Flavonoids and terpene trilactones, especially, ginkgo flavonglycosides, ginkgolides and bilobalides in leaves of ginkgo trees, need to be studied for effective application of these active components with high medical and health-care values. This study was aimed to provide scientific bases for genealogies selection and harvest season confirmation for *Ginkgo biloba*. A high-performance liquid chromatographic method (HPLC-ELSD) was developed to determine the contents of terpene trilactone, flavonoid of 36 ancient *Ginkgo biloba* genealogies from 19 provinces in China. The study indicated that the content gradually increased from April to August, thereafter declined. Analysis of variance indicated that the contents of terpene trilactone, flavonoids, and their respective components had significant difference among 36 genealogies. The cluster analysis showed that No. 72 (Xing'an, Guangxi), No. 58 (Youyang, Chongqing), No. 82 (Rugao, Jiangsu), No. 123 (Huixian, Gansu), No. 99 (Dujun, Guizhou), No. 10 ( Tai'an, Shandong) and No. 133 (Mentougou, Beijing) genealogies have higher content of terpene trilactone and flavonoid. Those results can help us to select superior variety containing high content of terpene trilactone and flavonoid.

**Keywords:** ancient *Ginkgo biloba*; terpene trilactone; flavonoid; HPLC-ELSD; genetic analysis; Q-cluster analysis

## 1. Introduction

*Ginkgo biloba* originated in the Permian and further flourished during the Jurassic. Now it is mainly distributed in China, Japan, and Korea, and believed to originate in mountainous valleys of Tianmu Mountain, Zhejiang Province, China (Singh et al., 2008). *G. biloba* was used as a herbal preparation dated back to approximately 5 000 years ago, when ancient Chinese ingested brewed leaf extracts to treat cardiovascular and bronchial diseases (Dubber and Kanfer, 2006; Pereira et al., 2013, 2015). Ginkgo's pharmacological value is attributed to the synergism of 2 distinctly different chemical classes, the flavonoids and terpene lactones. Flavonoids are the polyphenolic, low molecular weight compounds, ubiquitous in the plant and have been extensively studied, especially for their antioxidant and free radical scavenging activity (Singh et al., 2008). Terpene trilactones is the cage like compounds and extraordinarily stable despite the presence of the multiple oxygen functionals. Ginkgolides A, B, C, J and bilobalide are found exclusively in *Ginkgo biloba*. Their action involves the inhibition of platelet activating factor (PAF) while studies have shown that bilobalide, a related sesquiterpene compound has neuro-protective effects (Beek, 2002; Dubber and Kanfer, 2006; Beek and Montoro, 2009). *G. biloba* has been planted on a large scale in France and the United States. In Eastern China, after 1992, ginkgo seedlings have

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