

Review and Progress

Open Access

Effects of Cultivation Environment on the Yield of *Fritillaria thunbergii* and the Accumulation of Peimine

Xiaoying Li¹, Jianhua Wang² ✉¹ Songyang Xiaoying Family Farm, Songyang, 323400, Zhejiang, China² Songyang Shuimoshicang Agricultural Products Co. Ltd., Songyang, 323499, Zhejiang, China✉ Corresponding author: wjianhua2009@vip.qq.comMedicinal Plant Research, 2026, Vol.16, No.1 doi: [10.5376/mpr.2026.16.0005](https://doi.org/10.5376/mpr.2026.16.0005)

Received: 29 Jan., 2026

Accepted: 13 Mar., 2026

Published: 28 Mar., 2026

Copyright © 2026 Li and Wang, This is an open access article published under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Preferred citation for this article:

Li X.Y., and Wang J.H., 2026, Effects of cultivation environment on the yield of *Fritillaria thunbergii* and the accumulation of peimine, Medicinal Plant Research, 16(1): 69-91 (doi: [10.5376/mpr.2026.16.0005](https://doi.org/10.5376/mpr.2026.16.0005))

Abstract *Fritillaria thunbergii* Miq. is a commonly used traditional Chinese medicinal herb and a representative geo-authentic medicinal material of Zhejiang Province. Its underground bulb is the main medicinal part, and steroidal alkaloids such as peimine and peiminine are important indicators for evaluating its medicinal quality. With the transition of *F. thunbergii* production from traditional experience-based cultivation to standardized, large-scale, and high-quality cultivation, improving bulb yield while maintaining stable peimine accumulation has become a key issue in industrial development and quality control. This study focuses on the effects of cultivation environment on the yield of *F. thunbergii* and peimine accumulation, and analyzes the regulatory effects of light, temperature, water, soil, regional ecological conditions, and different cultivation patterns on plant growth, bulb enlargement, dry matter accumulation, and secondary metabolism. The results indicate that suitable light and temperature conditions, stable water supply, favorable soil structure, rational nutrient management, and a healthy rhizosphere microecology are important foundations for promoting high-quality and high-yield cultivation of *F. thunbergii*. In contrast, unfavorable environmental factors, such as excessive shading, high temperature, drought, waterlogging, soil compaction, and continuous cropping obstacles, may affect photosynthesis, root absorption, and bulb development, thereby causing yield reduction or quality fluctuation. Meanwhile, moderate environmental regulation can promote peimine accumulation by influencing carbon assimilation, hormone signaling, rhizosphere microecology, and pathways related to steroidal alkaloid biosynthesis. Future cultivation of *F. thunbergii* should aim to achieve the coordinated improvement of yield and quality by integrating ecological suitability zoning, comprehensive light-temperature-water-fertilizer management, soil environment optimization, and the construction of a quality evaluation system, thereby promoting the standardized, green, and sustainable development of the *F. thunbergii* industry.

Keywords *Fritillaria thunbergii*; Cultivation environment; Bulb yield; Peimine; Quality formation

1 Introduction

Fritillaria thunbergii Miq., a perennial herb of the genus *Fritillaria* in the family Liliaceae, is used medicinally as its dried bulb. It is one of the commonly used traditional Chinese medicinal materials in China and a representative geo-authentic medicinal material of Zhejiang Province. *F. thunbergii* has a long history of medicinal use and is clinically applied mainly for clearing heat and resolving phlegm, relieving cough and promoting expectoration, dissipating nodules, and resolving carbuncles. It has shown important application value in the intervention of respiratory diseases, pneumonia, inflammatory diseases, and related metabolic disorders (Nile et al., 2021). Modern pharmacological and phytochemical studies have shown that the bulbs of *F. thunbergii* contain various active substances, including alkaloids, polysaccharides, saponins, flavonoids, and volatile components. Among them, steroidal alkaloids such as peimine and peiminine have received particular attention and constitute an important material basis for its antitussive, expectorant, anti-inflammatory, antitumor, and antioxidant pharmacological effects (Huang et al., 2024a; Zou et al., 2026). Because peimine-type components are often regarded as important quality markers of *F. thunbergii* medicinal materials and their preparations, their content directly affects clinical efficacy, quality evaluation, and commercial value (Sui et al., 2021; Cheng et al., 2023; Zhou et al., 2023). With the continuous advancement of traditional Chinese medicine modernization and quality standardization of Chinese medicinal materials, *F. thunbergii* not only maintains stable demand in the field of traditional decoction pieces, but is also increasingly applied in Chinese patent medicine development,