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Review

The ethnobotanical, phytochemical and pharmacological profile of the genus *Pinellia*

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ABSTRACT

The genus *Pinellia* (Araceae), consisting of nine species, is mainly distributed in Eastern Asia. In traditional medicine, some *Pinellia* species have long been used for the treatment of various ailments, such as cough, vomiting, inflammation, epilepsy, cervical cancer and traumatic injury. Pharmacological studies revealed that *Pinellia* species possess a wide range of biological activities including cytotoxic, anti-tumor, antiemetic, insecticidal, antitussive, antimicrobial and anticonvulsant activities. However, some species also showed significant toxicity such as reproductive toxicity, mucosal irritation and hepatotoxicity. Most of these bioactivities and toxicity can be explained by the presence of various alkaloids and lectins. This review summarizes the ethnopharmacological uses, phytochemical constituents, pharmacological activities and toxicity of *Pinellia* species.

Contents

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1. Introduction

The genus *Pinellia* (Araceae) is mainly distributed in Eastern Asia (China, Japan and Korea), and comprises the following nine species: *Pinellia tripartita* (Blume) Schott, *Pinellia pedatisecta* Schott, *Pinellia integrifolia* N. E. Brown, *Pinellia ternata* (Thunb.) Breit., *Pinellia cordata* N. E. Brown, *Pinellia peltata* C. Pei, *Pinellia polyphylla* S. L. Hu, *Pinellia yaoluopingensis* X. H. Guo & X. L. Liu and *Pinellia fujianensis* H. Li & G. H. Zhu [1–3]. In traditional Chinese medicine (TCM), *Pinellia* species have been used throughout history, and *P. ternata* (Chinese name "Banxia") has been recorded in Chinese Pharmacopoeia (2010 Edition) as a common TCM for the treatment of cough, vomiting, infection and inflammation [4,5]. Also, *P. ternata* is widely used in many traditional medicine preparations, such as Banxia Houpu Decoction and Xiaoqinglong Decoction [6,7]. However, due to its toxicity, processed products, especially Rhizoma Pinelliae Praeparatum (Chinese name "fabanxia") and Rhizoma Pinelliae Praeparatum Cum Alumine (Chinese name "qingbanxia"), are a better choice in clinical use. In addition, *P. pedatisecta* has also been in folk medicine to cure thanatophidia bite, nameless swelling and toxicum, and cancer [8].

Over the past decades, the chemical constituents and pharmacological activities of different *Pinellia* species have been extensively studied. A lot of compounds including alkaloids, lectins, fatty acids, cerebrosides, volatile oils and phenylpropanoids have been isolated from *Pinellia* species. Pharmacological investigations revealed that the chemical constituents and extract of *Pinellia* species possess diverse bioactivities, such as cytotoxic, anti-tumor, antiemetic, insecticidal, antitussive, antimicrobial, antifungal, antiviral, sedative, hypnotic and anticonvulsant activities. Toxicological studies have been reported about the reproductive toxicity, mucosal irritation and hepatotoxicity. Recently, *Pinellia* species have been the focus of many scientific researches investigating their alkaloids and lectins for different bioactivities, especially cytotoxicity against various human cancer cell lines and anti-tumor activity in preclinical animal models as well as the toxicity. The present review is an up-to-date and comprehensive analysis of the ethnopharmacological uses, chemical constituents, pharmacological activities and toxicology of *Pinellia* species.

2. Ethnopharmacological uses

2.1. Traditional uses

The uses of *Pinellia* species for ethnomedicinal purpose in China can be dated back to 2000 years ago. According to the TCM theory, *Pinellia* species have been mainly used to eliminate phlegm, inhibit vomiting, dispel wind and relieve convulsion, and eliminate stagnation [1,9,10]. *P. ternata* was first record in the ancient Chinese medical book "*Shen Nong Ben Cao Jing*" and has been traditionally used to treat cough, vomiting, infection and inflammation [4,5,11]. Its rhizome is also used in many empirical formulas (Table 1) which are used clinically for the therapy of exogenous diseases, miscellaneous disease and gynecological disease [27]. A traditional Chinese medicine preparation "Banxia Houpu Decoction" has recently received much interest because of its good therapeutic effect on depression-related diseases and vomiting caused by cancer chemotherapy [6,28]. *P. pedatisecta* tuber was recorded to possess efficacy in dispelling wind and relieving convulsion, drying dampness to eliminate phlegm, and eliminating stagnation, and has been used as an anticancer agent for hundreds of years [1,8,9]. The tubers of *P. cordata* are traditionally used for all kinds of pain, envenomization, stomachache, traumatic injuries, arthritis, rheumatism, cancerous tumors and skin diseases. Its powders encased in No. 0 capsules (0.5 g each tablet) are clinically used as analgesic and anti-inflammatory agents in Zhejiang province [1,9,10]. *P. peltata* tubers are used to treat viper bites, traumatic injuries, mammary abscess and pyogenic infections [29]. *P. integrifolia* herbs have been used for the treatment of traumatic injuries and gonorrhea [30].

In Japanese Kampo medicine, *P. ternata* is used as an active herbal component. Sho-seiryu-to (Chinese name: Xiao-Qing-Long-Tang) has been used clinically for the treatment of allergic rhinitis, bronchitis, bronchial asthma and cold symptoms [7,31]. Kakkon-to (Chinese name: Ge-Gen-Tang), are also used for the treatment of cold syndromes [32,33]. Choto-san (Chinese name: Gou-Teng-San) has been used for a long time to treat chronic headache, vertigo, tinnitus, painful tension of the shoulders and cervical muscle, hypertension, vascular dementia and insomnia, particularly in middle-aged or older patients with weak physical constitutions. Moreover, the clinical efficacy in patients with vascular dementia has been demonstrated by a double blind and placebo controlled study [34–36]. Saiboku-To showed good therapeutic effect for bronchial asthma, chronic bronchitis and bronchiectasis which has been established by multicenter trials [37,38]. To guide clinical applications and offer a reference for quality control of these decoctions, further studies should focus on their active constituents and systemic quality control methods.

2.2. Adulterants and their identification

Typhonium flagelliforme (Lodd) Blume (Araceae family) is a counterfeit drug. Its antitussive and antiemetic effect is slightly weaker than *P. ternata*, while its toxicity is three times higher than that of *P. ternata* [39,40]. Therefore, it is essential