

Taxonomy and Sustainable Utilization of *Epimedium* L.

Zhang HF^a, Dong JZ^a, Zhu HT^b, Wang Ya^{a,*}, Zhao LD^c

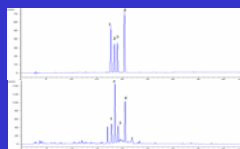
^a Key Laboratory of Plant Conservation Genetics, Wuhan Botanical Garden, Chinese Academy of Sciences, Wuhan 430074, PR China;

^b Taihe Affiliated Hospital, Yuyang Medical College, Shiyang 442000, PR China; ^c Faculty of Life Science, Huazhong Normal University, Wuhan 430079, PR China

Species of *Epimedium* L. (Berberidaceae) widely distribute from Japan to Algeria and mainly occur in eastern Asia and the Mediterranean region. Approximately 80% of the total species are found in central-southeastern China. Some species are used as the Chinese herbal medicines for over 2000 years. Five species, *Epimedium brevicornu* Maxim., *E. sagittatum* (Sieb. et Zucc.) Maxim., *E. wushanense* T.S. Ying, *E. pubescens* Maxim. and *E. koreanum* Nakai, are listed in the Pharmacopoeia of the People's Republic of China and called by a joint name of Herba Epimedii (Yin-Yang-Huo, in Chinese). Herba Epimedii is also utilized as a herb in Japan, Korea and the Mediterranean region. Herba Epimedii has been used to treat cardiovascular diseases and other chronic illness such as infertility, amnesia and neurasthenia, impotence, senile functional diseases and so on. However, the natural system of *Epimedium* L. is still a big challenge. In addition, identification of *Epimedium* species affects the medicinal utilization of the genus. Traditional classification of *Epimedium* species, mainly depended on the morphological characters, is inadequate. As a result, cytotaxonomy, chemotaxonomy and molecular taxonomy are helpful to the natural arrangement of *Epimedium* species. In our laboratory, a simple reversed-phase high performance liquid chromatographic (RP-HPLC) method has been developed for simultaneous determination of epimedin A, epimedin B, epimedin C and icariin in the leaves of *Epimedium* species. A variety of researches demonstrated that icariin, epimedin A, B and C possess significant pharmacological activities and occur widely across species of the genus. More importantly, the content of epimedin A, B or C in some species are higher than that of icariin. Therefore, epimedin A, B, C and icariin should be regarded as the marker compounds for characterizing Herba Epimedii. The occurrence and distribution of the four flavonoids (epimedin A, B, C and icariin) in different *Epimedium* species provide evidence for chemotaxonomy of the genus. Besides, this method can be easily applied to the quality control of Herba Epimedii. Amplified fragment length polymorphisms (AFLP) of the species, subspecies and varieties of *Epimedium* L. are also studied in our laboratory. Owing to the wide range of beneficial health effects and specific pharmacological effects of Herba Epimedii, demand for this Chinese herbal medicine increases rapidly since 1990s. In order to protect the wild resource of the genus, strategies for sustainable resource utilization are recommended. Introduction and cultivation of suitable *Epimedium* species according to good agricultural practice (GAP) were performed in our laboratory. Strategies of plant cell or organ cultures, metabolic engineering and microbial fermentation are also proposed.



E. leptorrhizum Stearn



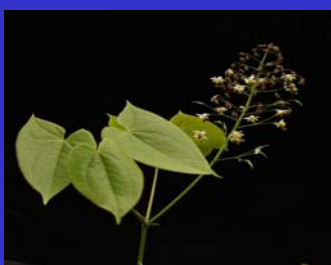
Chromatogram of reference substances (epi) and sample (herbar) of epimedin A, B, C and icariin. 1-1, 2 and 3 represent epimedin A, B, C and icariin, respectively.



E. brevicornu Maxim.



E. sagittatum Maxim.



E. brevicornu Maxim.



E. dewuense S.Z. He, Probst et W.F. Xu



E. wushanense T.S. Ying



E. franchetii W.T. Stearn