

# A *Taxus* leafy branch with attached ovules from the Lower Cretaceous of Inner Mongolia, North China



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## ABSTRACT

*Taxus guyangensis* sp. nov. is from the Lower Cretaceous Guyang Formation of the Guyang Basin of Inner Mongolia in northern China, based on an excellently preserved leafy branch with attached leaves and seed-bearing structures. Three ovules occur on the leafy branch. A pair of ovules is borne on the terminal ovuliferous shoot, and another one appears on the terminal of a lateral shoot. The aril and three pairs of decussate bracts are preserved at the base of a mature ovule. This fossil is the most complete evidence of this genus currently known. This discovery also indicates that the multi-ovulate shoot of *Taxus* existed in the Early Cretaceous. The reliable fossil record of *Taxus* is summarized in detail. Comparisons of *T. guyangensis* sp. nov. with living and previously published reliable fossil species of *Taxus* and *Taxus*-like fossils reveal that the present fossil materials cannot be assigned to any of these species. *T. guyangensis* has a close resemblance to extant *T. brevifolia* and might have represented the ancestral taxa of *T. brevifolia*. The new species together with other known fossil record of *Taxus* show that the age of *Taxus* dates back to the Early Cretaceous and that the divergence time of *Taxus* and *Pseudotaxus* is probably no later than the Early Cretaceous.

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## 1. Introduction

*Taxus* Linnaeus, commonly known as yew, is one genus in the Taxaceae (Stewart, 1983; Price, 1990). Species of *Taxus* L. are small to medium-sized trees or evergreen shrubs. Their leaves are helically arranged on branches in two ranks, and their seeds are enclosed within a cupular aril but with the apex exposed (Fu et al., 1999). Extant *Taxus* species are widely distributed throughout the Northern Hemisphere and extend as far south as El Salvador in Central America, Indonesia, the Philippines and Sumatra in Southeast Asia (Ferguson, 1978; Cope, 1998; Farjon, 1998; Fig. 1). *Taxus* contains seven to twelve species or subspecies (Pilger, 1903, 1916; Silba, 1984, 1986; Cope, 1998; Farjon, 1998, 2001; Fu et al., 1999; Li et al., 2001; Wang and Ran, 2014).

In Taxaceae and Cephalotaxaceae, foliar morphologic characters and any reproductive organs and leaf anatomy were demonstrated to possess an important value in taxonomy (Florin, 1931; Harris, 1976a,b; Ferguson, 1978; Tomlinson and Takaso, 2002; Ghimire et al., 2014). Unfortunately, the fossil record of the genus is poor,

especially for fossils showing reproductive organs. Most *Taxus* fossil remains are fragmentary with detached foliage shoots, leaves or seeds (Givulescu and Olos, 1973; Kvaček, 1976, 1984; He et al., 1979; Chen et al., 1988; Manchester, 1994; Deng, 1995; Deforce and Bastlaens, 2007; Kvaček and Rember, 2007; Macovei, 2013).

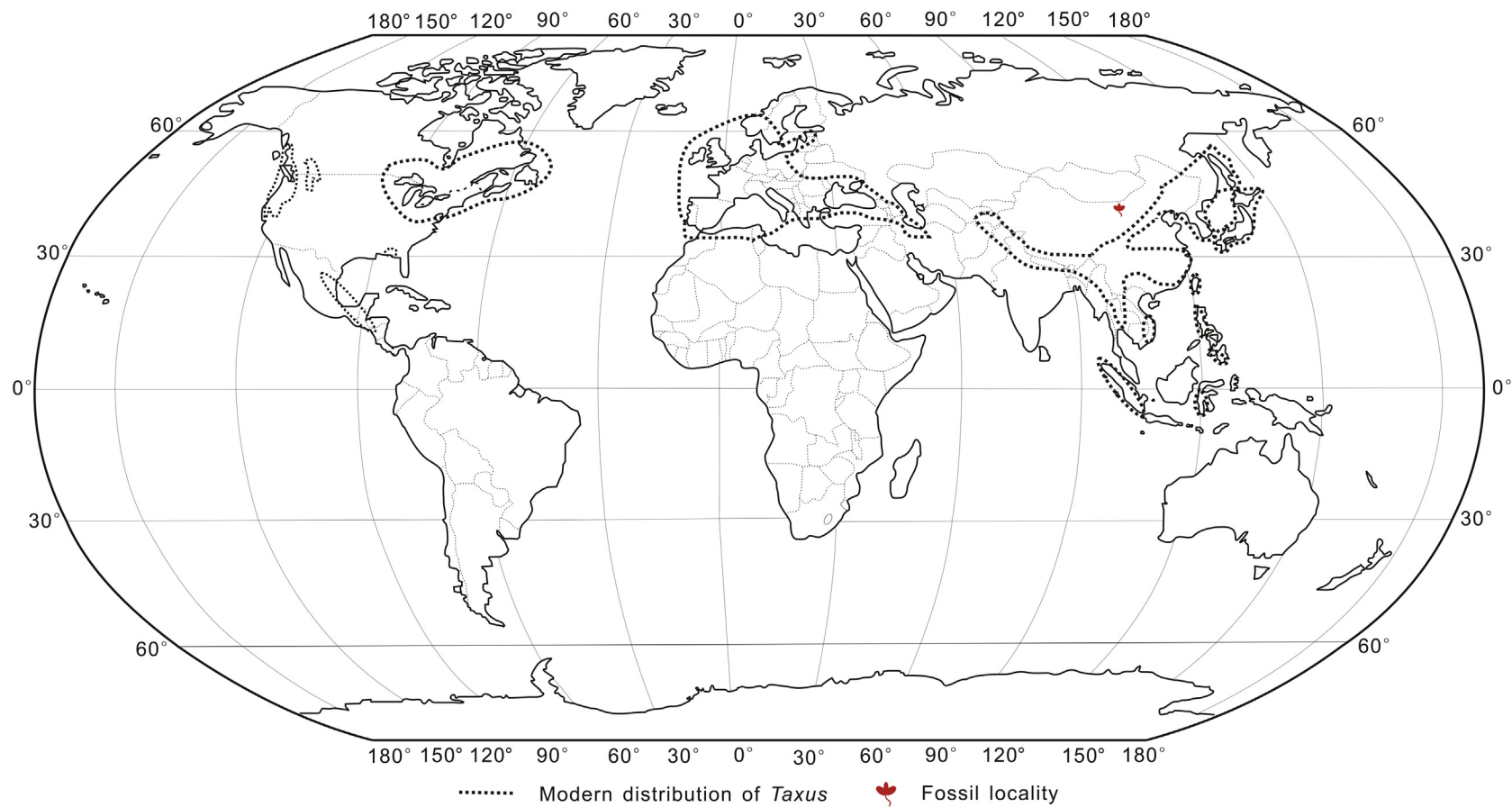
In the present study, a new species of *Taxus* is reported and described based on a completely preserved leafy branch with attached leaves and seed-bearing structures from the Lower Cretaceous Guyang Formation of the Guyang Basin, in Inner Mongolia, China. This is the most complete fossil evidence of this genus currently known. The newly described species is compared in detail with living and reliable fossil species of *Taxus* and some other related fossil taxa in terms of morphology and anatomy. Together with other known fossil occurrences of *Taxus*, this new species provides an important opportunity to understand the evolution and phylogenetic history of *Taxus* in the Cretaceous.

## 2. Locality and stratigraphy

The fossils were collected from the Lower Cretaceous Guyang Formation of the Guyang Basin, which is located in the central part

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**Fig. 1.** World distribution of extant *Taxus*, and fossil locality (based on Florin, 1963 with corrections).

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