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New species *Dalembia jiayinensis* (Magnoliopsida) from the Upper Cretaceous Yong'ancun Formation, Heilongjiang, northern China

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ABSTRACT

Leaves of *Dalembia jiayinensis* sp. nov. are reported from the Santonian Yong'ancun Formation exposed along the Heilongjiang (Amur) River in Jiayin County, Northeast China. The leaves are compound, odd-pinnate, consisting of five leaflets. Leaflets are pinnately-lobed, trilobate or unlobed, elliptic, oblong, elliptic-rhomboid or ovate in outline, with blunt or rounded apex and the leaflet base is variable being cuneate, slightly decurrent, truncate or slightly cordate and sometimes asymmetric. Margin is entire or lobed. Lobes are short, simple, decreasing upwards, with wide and rounded sinuses. Apices of the lobes are usually rounded, sometimes notched. Venation is pinnate or palmately-pinnate, craspedodromous or semi-craspedodromous. The new species *D. jiayinensis* extends both the geographical and stratigraphic ranges of the genus *Dalembia*. This is the first occurrence of *Dalembia* in China and the most southern and youngest (Santonian) occurrence of this genus.

1. Introduction

The genus *Dalembia* was established by Lebedev and Herman (1989) for compound imparipinnate leaves with pinnately-lobed leaflets. These authors included six species in this genus: *D. vachrameevii* E. Lebedev et Herman, *D. bolschakovae* E. Lebedev et Herman, *D. faradjevii* E. Lebedev et Herman, *D. pergamentii* Herman et E. Lebedev, *D. krassilovii* Herman et E. Lebedev and *D. comparabilis* (Hollick) Herman et E. Lebedev. Members of the genus *Dalembia* are common components of the Cenomanian to the Coniacian floras of Northeastern Asia and Alaska (Lebedev and Herman, 1989). The systematic position of *Dalembia* is unclear. No similar genera are known in either fossil or living taxa.

In this paper, we describe a new species *Dalembia jiayinensis* on the basis of leaf remains from the Upper Cretaceous Yong'ancun Formation, Jiayin County, Heilongjiang Province, Northeastern China. The geographical and stratigraphic implications of the new species are discussed.

2. Geological setting

Many new data about the stratigraphy and biota of the Upper Cretaceous deposits of the Amur (Heilongjiang) River area were obtained as a result of the activity of the international research project for the study of events surrounding the Cretaceous/Paleogene boundary, organized by the Research Center of Paleontology of Jilin University (Sun et al., 2002, 2011, 2014).

The Upper Cretaceous terrigenous deposits in Jiayin area are divided into the Yong'ancun, Taipinglinchang, Yuliangzi and Furao Formations (Bureau of Geology and Mineral Resources of Heilongjiang Province, 1993). The Yong'ancun Formation is underlain by white rhyolite of the Ningyuancun Formation (the geological age is unclear) and conformably overlain by oil shale of the Taipinglinchang Formation with remains of ostracods and conchostracans. Upper member of the Taipinglinchang Formation consists of greyish-brown siltstone and fine-grained sandstone which yields abundant plant remains (Zhang, 1983; Sun et al., 2007, 2014; Golovneva et al., 2008; Quan and Sun, 2008).

The thickness of the Yong'ancun Formation is about 970 m. The deposits of the Yong'ancun Formation outcrop mainly along the

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right bank of the Heilongjiang (Amur) River in the east hill of Yong'ancun villages, about 15 km to the east of Jiayin town (Fig. 1). The Yong'ancun Formation consists of alternated yellow brown cross-bedded sandstones, greenish-gray and brownish-gray siltstones and mudstones, intercalated by pebbled sandstones and conglomerates, representing alluvial-lacustrine facies of an intermontane depression in the Zeya-Bureya sedimentary basin (Bureau of Geology and Mineral Resources of Heilongjiang Province, 1993; Suzuki et al., 2004; Sun et al., 2011). In this formation plant mega- and microfossils, ostracods, bivalves, conchostracans and dinosaur footprints *Jiayinosauropsis johnsoni* Dong, Zhou et Wu have been found (Dong et al., 2003; Sun et al., 2007, 2011; Markevich et al., 2011).

Plant fossils are rather rare in the Yong'ancun Formation. In 2002 and 2004 two fossiliferous beds (coordinates 48°50′59″ N, 130°31′30″ E) were found in the bank outcrop along Heilongjiang River (Fig. 2B). The preliminary study reveals the following taxa: *Asplenium dicksonianum* Heer, *Metasequoia* sp., *Taxodium* sp., *Sequoia* sp., *Cupressinocladus* sp., *Ginkgo* ex gr. *adiantoides* (Ung.) Heer, *Trochodendroides* sp., *Quereuxia angulata* (Newb.) Krysht. ex Baik.

In 2014, a new road construction exposed higher layers of the Yong'ancun Formation above bank outcrop (coordinates 48°50′57″ N, 130°31′24″ E), that give the opportunity to gather a new collection of plant fossils in the top of the formation in several meters below the boundary with the Taipinglinchang Formation (Fig. 2A). Plant remains are more diverse at this level. Besides new species of *Dalembia* during field season in 2015 numerous impressions of leaves and fruits were found, including horsetails (*Equisetum*), ferns (*Osmunda, Asplenium, Salvinia*), ginkgoales (*Ginkgo*), conifers (*Cupressinocladus, Taxodium, Metasequoia, Sequoia, Pityophyllum*) and angiosperms (*Trochodendroides*, *Nyssidium, Platanus, Arthollia*, *Quereuxia,* and *Cobbania*).

Fig. 2. Outcrops of the Yong'ancun Formation in the east hill of Yong'ancun village: A – outcrop along the new road, upper part of the Yong'ancun Formation; B – outcrop along the right bank of the Heilongjiang (Amur) River, middle part of the Yong'ancun Formation.

Fig. 1. Map of Jiayin county, China, with *Dalembia jiayinensis* locality near Yong'ancun village.