

Bauhinia larsenii, a fossil legume from Guangxi, China

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Fossil leaves and a branch with a leaf and a pod attached have been discovered from Ningming County, Guangxi Autonomous Region, China, and are described as *Bauhinia larsenii* sp. nov. (Leguminosae: Cercideae). The strata from which the *Bauhinia* fossils were collected, namely the Ningming Formation, were dated as Late Eocene–Oligocene based on a combination of pollen, fauna and flora. The affinity of the new species to *Bauhinia* section *Micralvesia* subsection *Viridescentes* species is also discussed. © 2005 The Linnean Society of London, *Botanical Journal of the Linnean Society*, 2005, 147, 437–440.

ADDITIONAL KEYWORDS: Caesalpinioideae – Cercideae – Leguminosae – Oligocene.

INTRODUCTION

Bauhinia L., a pantropical genus of c. 300 species of trees, shrubs and lianas (Wunderlin, Larsen & Larsen, 1987), is the largest genus in the legume tribe Cercideae, which the most recent studies (Polhill, Raven & Stirton, 1981; Wunderlin, Larsen & Larsen, 1981, 1987; Käss & Wink, 1996; Bruneau *et al.*, 2001; Kajita *et al.*, 2001) have revealed to be an early offshoot in the Leguminosae. In China, *Bauhinia* is represented by nearly 50 species (Chen, 1988; Zhang, 1993; Zhang & Chen, 1996, 1998) distributed in the warmer part of the country.

Fossils referable to the genus *Bauhinia* have been documented from the Quaternary of the Caribbean region in the form of pollen grains (Graham, 1992); from the Oligocene of Mexico as leaves [Calvillo-Canadell & Cevallos-Ferriz, (2002), who described a new genus, *Bauhcis*]; from the Miocene of India (Awasthi, 1992) as leaves and woods; while the earlier records of *Bauhinia* leaves from the Cretaceous and the Palaeogene have been dismissed as non-legumes (Herendeen, Crepet & Dilcher, 1992). Although *Cercis* leaves and pods have been described from the Miocene

Shanwang Flora (Hu & Chaney, 1940), *Bauhinia* fossils have never previously been found in China.

Recently, Li *et al.* (2003) described a new species, *Palaeocarya guangxiensis*, based on fruit remains from the same locality as the present fossils. The site has been dated as Oligocene or possibly Late Eocene based on palynological data (Wang, Chen & Chen, 2003), or early Miocene based on a fish fauna (Chen, Chen & Kuang, 2004). In studying the macrofossils of the Leguminosae, we found a specimen that consists of a branch with a bilobed leaf and a pod attached, and several other specimens of pods and leaves that are apparently conspecific with the branching specimen.

MATERIAL AND METHODS

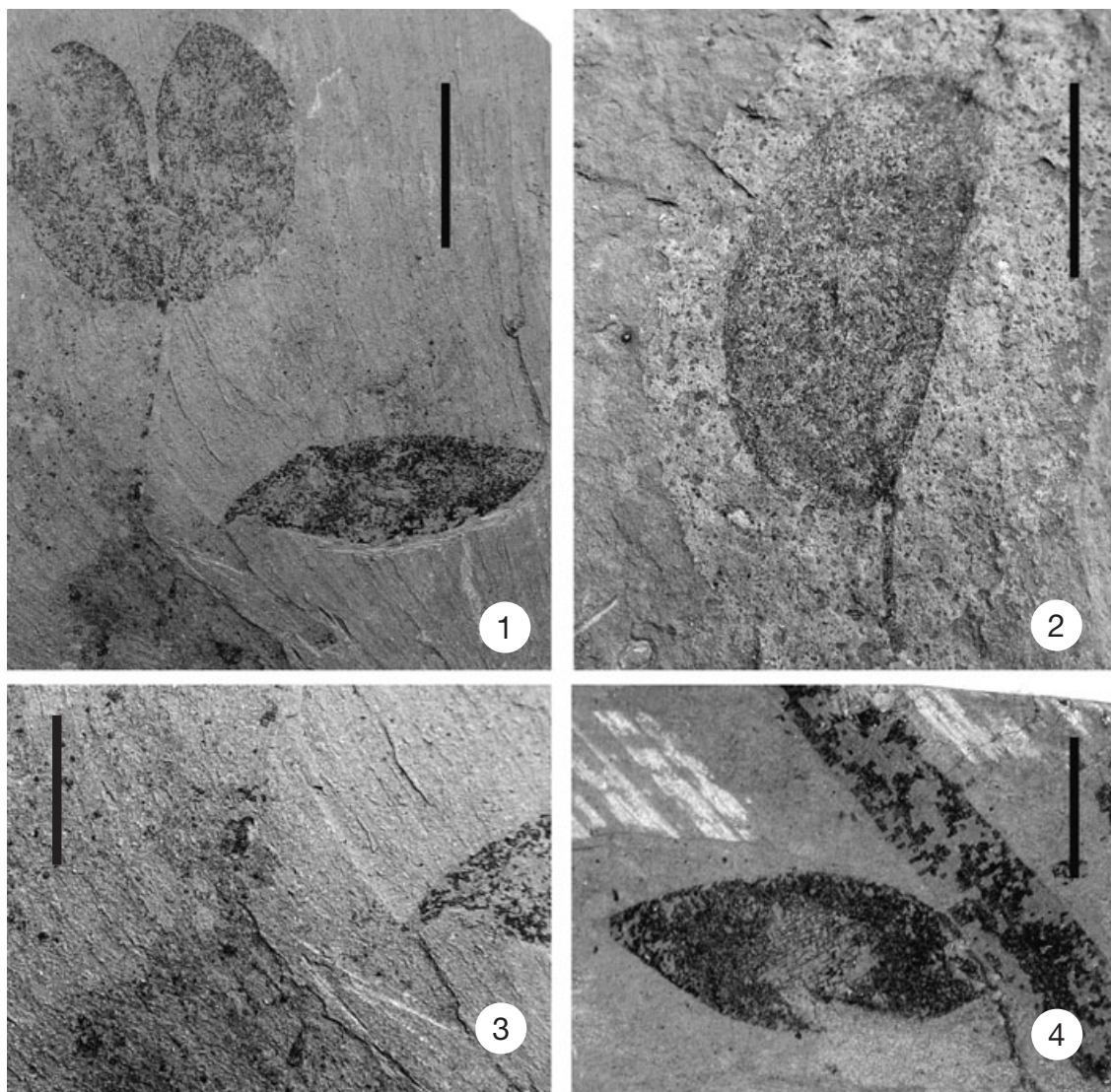
Fossil plants were collected from the north-west of Ningming county, Guangxi Zhuang Autonomous Region (22°07.690'N, 107°02.434'E) from the Tertiary Ningming Formation (Li, Qiu & Li, 1995). Fossils mostly occur in a grey mudstone intercalated with thin sandstones. The well developed beds show a dip of 6–10°. The bottom of the sequence is 146 m a. s. l., and the outcrop is about 100 m thick. It has yielded various fossil plants and fossil fish. The pollen assemblage, characterized by angiosperm pollen mainly from the Fagaceae, Betulaceae and Hamamelidaceae

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along with sporadic herbaceous taxa, e.g. Polygonaceae and Ranunculaceae, is considered 'at least' Late Eocene–Oligocene in age (Wang *et al.*, 2003), while the characteristics of the fossil fish suggest that the age of the locality is Early Miocene (Chen *et al.*, 2004). Because no volcanic material has been discovered at the locality, a radiometric date was not possible.

The specimens include a branching specimen with a leaf and a pod attached (GXMNH acc. no. 45003, Fig. 1 with counterpart acc. no. 45004), a pod (acc. no. 45019, Fig. 4), and a leaf (acc. nos. 45012, Fig. 2). The branching specimen (acc. nos. 45003, 45004) has an intact leaf and attached pod (Fig. 3, showing the attach-

ment), although the larger part of the stem is not preserved, with a faint impression still visible. When splitting the part and counterpart of the specimen (the split has passed through the centre of the leaf and the pod as both part and counterpart have visible structural remains), part of the stem might have been lost during the process. The leaf is an intact folded leaf showing the lower surface (acc. no. 45012). At higher magnification, some linear structures similar to trichomes are visible. The fruit (acc. no. 45019) shows a pod and an unidentifiable stem-like structure. The pod is very similar in size and shape to the pod that is attached to the branching specimen that also has an attached leaf. Unfortunately, the higher order veins



Figures 1–4. Fossils from Ningming, Guangxi. Fig. 1. A branch with attached leaf and fruit (Chen Yunfa 45003). Holotype of *Bauhinia larsenii*. Scale bar = 2 cm. Fig. 2. A folded leaf (Chen Yunfa 45012). Scale bar = 2 cm. Fig. 3. Branch, leaf petiole and fruit pedicel of the holotype, showing the attachment in detail. Scale bar = 1.1 cm. Fig. 4. A pod with an unidentifiable stem-like structure (Chen Yunfa 45019). Scale bar = 1 cm.

are not distinguishable in all the above-mentioned specimens.

TAXONOMIC TREATMENT

LEGUMINOSAE

CAESALPINIOIDEAE A. P. DE CANDOLLE

CERCIDEAE BRONN, 1822

BAUHINIA L.

BAUHINIA LARSENII D. X. ZHANG &
Y. F. CHEN **SP. NOV.** (FIGS 1–5)

LEAVES rounded or slightly ovate; 3–4.5 by 3–4 cm, 5–7-nerved; bifid to c. 1/2–3/5 of lamina length, midrib ended in a mucro; lobes rounded to obtuse; base rounded or shallowly cordate; lower surface sparsely pubescent. PETIOLE c. 2–3 cm long. Primary veins 5–7; lateral veins frequently branched; secondary veins diverging at c. 45° on the proximal side, fused with other secondary veins or the branches of primary veins to form loops near the leaf margin, or arcs between the primary veins; higher order veins not visible. Leaf margin consists of arcs and areoles, without a marginal vein. POD elliptic, c. 3.5 by 1.1 cm; stipe c. 0.3 cm long; apex acute. FRUIT pedicel c. 1 cm long. Seeds 2–4.

Holotype: Acc. no. 45003 (GXMNH!).

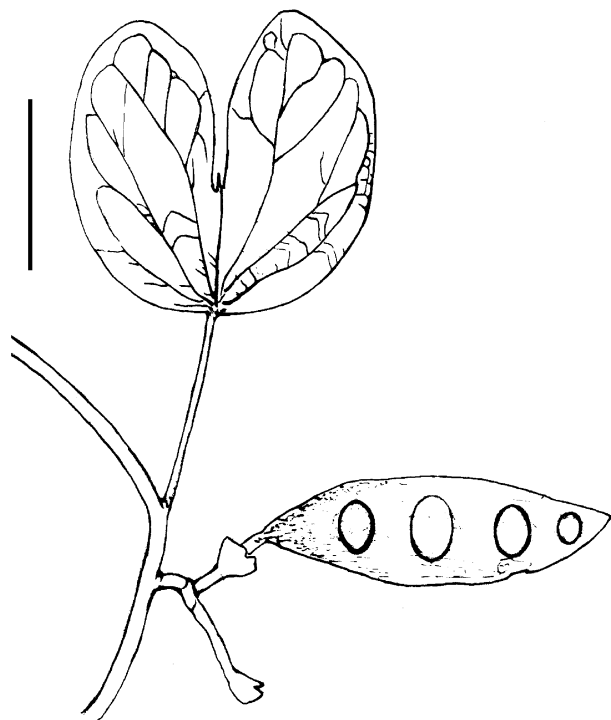


Figure 5. Interpretative drawing of the branch of *Bauhinia larsenii* based on the holotype, and its counterpart. Scale bar = 2 cm.

Paratypes: Acc. nos. 45004, 45012, 45019 (GXMNH!).

Etymology: Named in honour of Professor Kai Larsen, in recognition of his contribution to the systematic and floristic work on Asian legumes.

DISCUSSION

The only other genus in the Cercideae other than *Bauhinia* that has bilobed leaves is *Adenolobus*, an extant genus, species of which are found in Angola and Namibia in southern Africa. The leaf of *Adenolobus* has moderately developed secondary veins on the midrib, and interprimary veins that are easily distinguishable from *Bauhinia* (Zhang, 1994), and is incongruent with the present fossils. The present species is thus easily referred to *Bauhinia*.

The leaf shape, leaf venation pattern and pod morphology of the specimens are very similar to species in the *Bauhinia* subgenus *Bauhinia* section *Micralvesia* subsection *Viridescentes*, a subsection of four species in Asia of small trees and shrubs with bilobed leaves and (ob)elliptic pods (Wunderlin *et al.*, 1987). The pod attached to the fossil branch is, in particular, similar in shape and size to that of the species in the subsection, *Bauhinia brachycarpa*. This is a polymorphic species widely distributed in Guangxi, Yunnan, Sichuan, Xizang (Tibet) to Hubei and Gansu in China and also in Burma and Thailand, although extant populations do not occur in Ningming and adjacent counties in south-eastern Guangxi. One of the other species in subsection *Viridescentes* that also occurs in China, *B. viridescens* Desv., has much narrower pods, while *B. saccocalyx* Craib, a species occurring in neighbouring Thailand, has much larger leaves and pods.

After comparing the fossil material with the extant species in the genus, we concluded that the specimens represent a hitherto undescribed species of *Bauhinia*, and a new species is therefore proposed.

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