

= Archaeamphora =

Archaeamphora longicervia is an extinct species of flowering plant and the only member of the genus *Archaeamphora*. Fossil material assigned to this taxon originates from the Yixian Formation of northeastern China, dated to the Early Cretaceous (around 145 to 101 million years ago).

The species was originally described as a pitcher plant with close affinities to extant members of the family Sarraceniaceae. This would make it the earliest known carnivorous plant and the only known fossil record of pitcher plants (with the possible exception of some palynomorphs of uncertain nepenthacean affinity). *Archaeamphora* is also one of the three oldest known genera of angiosperms (flowering plants). Li (2005) wrote that "the existence of a so highly derived Angiosperm in the Early Cretaceous suggests that Angiosperms should have originated much earlier, maybe back to 280 mya as the molecular clock studies suggested".

Subsequent authors have questioned the identification of *Archaeamphora* as a pitcher plant.

= Etymology =

The generic name *Archaeamphora* is derived from the Greek *archaios* ("ancient"; combining form in Latin: *archae-*), and *amphoreus* ("pitcher"). The specific epithet *longicervia* is derived from the Latin *longus* ("long") and *cerviciarius* ("with a neck"), in reference to the characteristic constriction in the pitcher @-@ like structures of this species.

= Fossil material =

All known fossil material of *A. longicervia* originates from the Jianshangou Formation in Beipiao, western Liaoning, China. These Early Cretaceous beds constitute the lower part of the Yixian Formation, which is dated at 124 @.@ 6 million years old. Nine specimens of *A. longicervia* have been found, including holotype CBO0220 and paratype CBO0754.

= Description =

Archaeamphora longicervia was a herbaceous plant growing to around 50 mm (2 @.@ 0 in) in height. The stem, at least 21 mm (0 @.@ 83 in) long by 1 @.@ 2 mm (0 @.@ 047 in) wide, bore distinctive vertical ridges and grooves. The pitcher @-@ like structures were ascidiate in form and 30 to 40 mm (1 @.@ 2 to 1 @.@ 6 in) long. Mature pitchers and underdeveloped pitchers or phyllodia @-@ like leaves were arranged spirally around the stem. Pitchers consisted of a tubular base, expanded middle section, constriction around the mouth, and a vertical, spoon @-@ shaped lid. A single wing ran down the adaxial side of each pitcher. Three to five parallel major veins were present on the pitchers, along with a few intercostal veins and numerous small veinlets.

Two unusual bag @-@ like structures were present on each pitcher, one on either side of the central wing. Similar but semi @-@ circular structures were found on the margin of the lid. These structures exhibited strong yellow @-@ green intrinsic fluorescence when exposed to visible light with a wavelength of 500 nm (blue @-@ green).

Tiny glands, approximately 4 µm in diameter, were found on the inner surface of the pitchers and partially embedded in the grooves along the veins. These also showed very strong golden @-@ yellow fluorescence.

A single seed was found intimately associated with the fossil material of *A. longicervia* and is presumed to belong to the same species. It is winged and reticulate @-@ tuberculate in morphology, closely resembling the seeds of Sarraceniaceae taxa. The seed is oval @-@ shaped, covered with black @-@ brown warts, and measures 0 @.@ 9 by 1 @.@ 25 mm (0 @.@ 035 by 0 @.@ 049 in).

= Taxonomy =

The fossil material of *A. longicervia* was subjected to chemical analysis for oleanane, considered a key marker differentiating angiosperms from gymnosperms. Oleanane was detected in these specimens, suggesting that they belong to the angiosperms.

== Pitcher plant interpretation ==

According to Li (2005), several morphological features of *A. longicervia* indicate a close relationship to Sarraceniaceae: both taxa exhibit one or two pitcher wings, a smooth peristome, and pitchers that extend vertically from the top of a short petiole.

Li (2005) suggests that *A. longicervia* is morphologically similar to modern *Sarracenia purpurea*. It shares with this species the spiral arrangement of its pitchers and phyllodia @-@ like tubular leaves with parallel major veins. *Archaeamphora longicervia* also shows a resemblance to species of the genus *Heliampora* in having pitchers with a long neck and upright lid. Of particular note is the similarity between the thick semi @-@ circular structures on the lid of *A. longicervia* and the large nectar @-@ secreting "bubble" present on the upper posterior portion of *Heliampora exappendiculata* pitchers.

Li (2005) mentions the discovery of another type of "pitcher plant" from the same formation. This variety differs from the type material of *A. longicervia* in having pitchers that lack any constriction before the mouth, instead gradually expanding from the petiole into a hollow trumpet @-@ like shape. He suggests that it "should be a different species" from *A. longicervia*. An intermediate form with a wider neck is also reported, suggesting that these plants were already a diversified group in the Early Cretaceous.

== Current understanding ==

Heřmanová & Kvařek (2010) opined that the pitcher plant interpretation of *Archaeamphora* is "problematic and the fossil is in need of revision".

In their 2011 book, *Sarraceniaceae of South America*, McPherson et al. summarised current thinking on *Archaeamphora* as follows:

Serious doubt is emerging that reduces the likelihood that *Archaeamphora longicervia* belongs in the Sarraceniaceae lineage, or was even a pitcher plant at all. [...] Although *Archaeamphora* might well be a representative of the earliest flowering plants on Earth [...] it is very unlikely that it represents an ancestor of Sarraceniaceae since it is much too old to be part of the advanced "crown group" of Ericales to which Sarraceniaceae belong. [...] Another contradiction is that except for *Archaeamphora*, there is no other evidence to suggest that Sarraceniaceae evolved outside the New World, to which all extant members of the family are endemic.

Wong et al. (2015) put forward a new perspective [16] as follows:

Archaeamphora longicervia H. Q. Li was described as an herbaceous, Sarraceniaceae @-@ like pitcher plant from the mid Early Cretaceous Yixian Formation of Liaoning Province, northeastern China. Here, a re @-@ investigation of *A. longicervia* specimens from the Yixian Formation provides new insights into its identity and the morphology of pitcher plants claimed by Li. We demonstrate that putative pitchers of *Archaeamphora* are insect @-@ induced leaf galls that consist of three components: (1) an innermost larval chamber; (2) an intermediate zone of nutritive tissue; and (3) an outermost wall of sclerenchyma. *Archaeamphora* is not a carnivorous, Sarraceniaceae @-@ like angiosperm, but represents insect @-@ galled leaves of the previously reported gymnosperm *Liaoningocladus boii* G. Sun et al. from the Yixian Formation.

== Habitat ==

The area inhabited by *A. longicervia* is thought to have experienced significant climatic fluctuations during the Early Cretaceous, ranging from arid or semi @-@ arid to more humid conditions. The substrate in the region was mostly composed of lacustrine sediments and volcanic rocks.

