Ephedra

Ephedra is a genus of gymnosperm shrubs. The various species of Ephedra are widespread in many arid regions of the world, ranging across southwestern North America, southern Europe, northern Africa, southwest and central Asia, northern China and western South America.[2] It is the only extant genus in its family, Ephedraceae, and order, Ephedrales, and one of the three living members of the division Gnetophyta alongside Gnetum and Welwitschia.

In temperate climates, most Ephedra species grow on shores or in sandy soils with direct sun exposure. Common names in English include joint-pine, jointfir, Mormon-tea or Brigham tea. The Chinese name for Ephedra species is mahuang (simplified Chinese: ■■; traditional Chinese: ■■; pinyin: máhuáng; Wade–Giles: ma-huang; lit. 'hemp yellow'). Ephedra is the origin of the name of the stimulant ephedrine, which the plants contain in significant concentration.

The family Ephedraceae, of which Ephedra is the only extant genus, are gymnosperms, and generally shrubs, sometimes clambering vines, and rarely, small trees. Members of the genus frequently spread by the use of rhizomes.[3]

The stems are green and photosynthetic.[4] The leaves are opposite or whorled. The scalelike leaves fuse into a sheath at the base and this often sheds soon after development. There are no resin canals.[3]

The plants are mostly dioecious, with the pollen strobili in whorls of 1–10, each consisting of a series of decussate[5] bracts. The pollen is furrowed. The female strobili also occur in whorls, with bracts which fuse around a single ovule. Fleshy bracts are white (such as in Ephedra frustillata) or red. There are generally 1–2 yellow to dark brown seeds per strobilus.[3]

The genus Ephedra was first described in 1753 by Carl Linnaeus,[6][7][8] and the type species is Ephedra distachya.[7] The family, Ephedraceae, was first described in 1829 by Dumortier.[6][9]

The oldest known members of the genus are from the Early Cretaceous around 125 million years ago, with records being known from the Aptian-Albian of Argentina,[10] China,[11] Portugal and the United States.[12] The fossil record of Ephedra outside of pollen disappears after the Early Cretaceous.[13] Molecular clock estimates have suggested that last common ancestor of living Ephedra species lived much more recently, during the Early Oligocene around 30 million years ago.[14] However, pollen modified from the ancestral condition of the genus with branched pseudosulci (grooves), which evolved in parallel in the living North American and Asian lineages is known from the Late Cretaceous, suggesting that the last common ancestor is at least this old.[13]

E. ochreata

E. pedunculata

E. rupestris

E. nevadensis

E. californica

E. antisyphilitica (Clapweed)

E. frustillata

E. torreyana

E. aspera

E. trifurca

E. breana

E. boelckei

E. milleri

E. chilensis

E. triandra

E. tweedieana

E. andina

E. sinica

E. regeliana

E. rituensis

E. monosperma

E. lomatolepis

E. sarcocarpa

E. major

E. strobilacea

E. somalensis

E. pachyclada

E. foeminea

E. campylopoda

E. fragilis

E. foliata

E. ciliata

E. alata

E. aphylla

E. altissima

E. minuta

E. gerardiana

E. viridis

E. likiangensis

E. americana

E. equisetina

E. rhytidosperma

E. intermedia

E. przewalskii

E. distachya

E. procera

As of June 2021[update], Plants of the World Online accepted the following species:[17]

The genus is found worldwide, in desert regions, but not in Australia.[3]

Ephedraceae are adapted to extremely arid regions, growing often in high sunny habitats, and occur as high as 4000 m above sea level in both the Andes and the Himalayas.[3] They make up a significant part of the North American Great Basin sage brush ecosystem.

The Ephedra alkaloids, ephedrine and pseudoephedrine – constituents of E. sinica and other members of the genus – have sympathomimetic and decongestant qualities,[19] and have been used as dietary supplements, mainly for weight loss.[20] The drug, ephedrine, is used to prevent low blood pressure during spinal anesthesia.[19]

In the United States, ephedra supplements were banned from the market in the early 21st century due to serious safety risks.[20] Plants of the genus Ephedra, including E. sinica and

others, were used in traditional medicine for treating headache and respiratory infections, but there is no scientific evidence they are effective or safe for these purposes.[20]

Ephedra has also had a role as a precursor in the clandestine manufacture of methamphetamine.[21]

Alkaloids obtained from the species of Ephedra used in herbal medicines, which are used to synthetically prepare pseudoephedrine and ephedrine, can cause cardiovascular events.[19] These events have been associated with arrhythmias, palpitations, tachycardia and myocardial infarction.[19] Caffeine consumption in combination with ephedrine has been reported to increase the risk of these cardiovascular events.[19][20]

The earliest uses of Ephedra species (mahuang) for specific illnesses date back to 5000 BC. Ephedrine and its isomers were isolated in 1881 from Ephedra distachya and characterized by the Japanese organic chemist Nagai Nagayoshi. His work to access Ephedra's active ingredients to isolate a pure pharmaceutical substance led to the systematic production of semi-synthetic derivatives thereof is relevant still today. Three species, Ephedra sinica, Ephedra vulgaris, and to a lesser extent Ephedra equisetina, are commercially grown in Mainland China as a source for natural ephedrines and isomers for use in pharmaceuticals. E. sinica and E. distachya usually carry six optically active phenylethylamines, mostly ephedrine and pseudoephedrine with minor amounts of norephedrine, norpseudoephedrine as well as the three methylated analogs. Reliable information on the total alkaloid content of the crude drug is difficult to obtain. Based on HPLC analyses in industrial settings, the concentrations of total alkaloids in dried Herba Ephedra ranged between 1 and 4%, and in some cases up to 6%.[22]

For a review of the alkaloid distribution in different species of the genus Ephedra see Jian-fang Cui (1991).[23] Other American and European species of Ephedra, e.g. Ephedra nevadensis (Nevada Mormon tea) have not been systematically assayed; based on unpublished field investigations, they contain very low levels (less than 0.1%) or none at all.[24]