President's Message: Ephedra novelties in the Piute Mountains of Kern County[1]

by Richard Spjut

THE GENUS *EPHEDRA* (EPHEDRACEAE), IS a gymnosperm commonly known as **joint firs**. The genus is known from fossils dated more than 100 million years ago (mya), a time in the Cretaceous period when dinosaurs were roaming our planet. Despite the long evolutionary history of *Ephedra*, only about 56 species are generally recognized, since they diversified 30 mya. They spread from their ancestral homeland in the Mediterranean region of Europe and northern Africa to eastern Asia and from there to North America and on to South America, or perhaps they also spread west from Europe to South America via eastern North America[2]. Their geographic range is indicated in green on the world map (Wikipedia).

In Kern County, three species of *Ephedra* are recognized, ***E. californica***, ***E. nevadensis***, and ***E. viridis***. In addition I suspect the Death Valley *Ephedra* (***E. funerea***) may also occur here, most likely in the Piute Mountains with other relicts such as *Forsellesia* (Crossosomataceae).

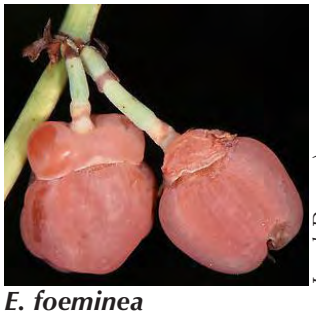
Ephedra species are classified by whether they have **two or three nodal leaves**; by **whether the stems grow closely parallel or branch at wide angles**; **whether the stem is more grayish than yellowish** in its green color; and **by seed number** (1 or 2 per floral cone) **and shape**. However, in the 2014 and 2015 September issues of the *Mimulus Memo*, I suggested other taxonomic differences — such as **stems appearing more square than round in x-section**; **longer-stemmed-leaves and seed-cone stalks than described**; **two kinds of leaves on the same plant** (image at end); and **seasonal differences in development of leaves and cones**. These character features indicate more species of *Ephedra* occur in Kern County as I have proposed on the **World Botanical Associates** webpage (*http://www.worldbotanical.com/ephedra.htm*).

Additionally, there is a **non-native *Ephedra*** I photographed along Erskine Creek in May 2012, at which time I was accompanied by **Dorie Giragosian** and **Clyde Golden** on a CNPS chapter field trip. I recently concluded that this plant is ***E. foliata***, a species found mainly in the semiarid regions of northern Africa, Europe and Asia, but not reported in California. However, it is cultivated in India, and likely in California[3]. Thus, it may have been cultivated near Lake Isabella. An example is the non-native ***E. foeminea***, an Eurasian - north African species found growing in Santa Barbara County where possibly naturalized (CCH2). It is distinguished from all other California species by the red fleshy bracts (JM2), which are likely dispersed by birds.

California Ephedra and **Death Valley Ephedra**. **Top left: *E. californica***, near the mouth of Kern River Canyon – plant in lower right foreground. **Top right: *E. funerea***, Dante's View, Death Valley National Park. **Below:** Pollen and seed cones of each species respectively.

Although developed pollen cones were evident in photo of one plant (not shown), seed of the Erskine Creek plants were not evident. In *E. foliata*, seeds may appear black covered by white to pinkish fleshy bracts.

I also photographed a plant similar in habit to the Erskine Creek *Ephedra* a month later (7 June 2012) along the Pacific Crest Trail northeast of Te-



E. foeminea

E. foliata

photos by Ori Fragman-Sapir on JungleDragon)


Nevada Ephedra and **Green Ephedra**. **Above, far left:** *E. nevadensis*, Walker Lake, NV and pollen (top) and seed cones (below) from separate plants. **Above, far right):** *E. viridis*, Walker Pass along Hwy 178, Kern Co., CA, plant with pollen cones, but no leaves when photo was taken in April. **To its left above**: *E. viridis* with leaves but no cones in September; leaves mostly opposite (2 per node), occasionally whorled (3 per node). **Below:** portion of another plant photographed in April near Walker Pass with seed cones; thus, it appears that leaves develop in the summer-fall and seeds develop in the spring after leaves are gone.



Ephedra foliata – **Center image:** One of three plants observed along east side of Erskine Creek on talus at base of cliff during CNPS field trip I led, accompanied by chapter members Dorie Giragosian and Clyde Golden, 8 May 2012. They stayed on the west side of the creek while I crossed to explore the rock walls, which were obscured by riparian vegetation. **Far left:** An enlarged portion of the center image to show small cones. **Right Image:** from ***Flora of Qatar*** website to show the remarkable similarity to the Erskine Creek ephedra.

Variation in leaf shapes on ***Ephedra*** cf ***viridis*** collected along south side of Kern River just below Lake Isabella dam. Leaves either mostly green with long linear extension to obtuse apex, or mostly a hyaline oval sheath with mid-nerve extended shortly into an acute apex.

Ephedra cf ***viridis*** with unusally dense pollen cones, growing near Bishop, CA. Photo taken May 4, 2008.

hachapi. (See photo on WBA website.) While it may be argued that *Ephedra* species can vary considerably in their habit, and the morphology of their stems and leaves, the combination of traits that I present here for the Erskine Creek plants agree more with *E. foliata* as seen in images of a plant in Qatar, and of a herbarium specimen on **SEINet** taken from a cultivated plant in India.

Eurasian species of *Ephedra* contain alkaloids, **ephedrine** and **pseudoephedrine** that have been used as dietary supplements, mainly for weight loss. The drug, ephedrine, is also used to prevent low blood pressure during spinal anesthesia. The plants were once banned from the US, and one might expect individuals to grow their own from plants imported from abroad, while it may be also noted that *E. foliata* was reported to have only a trace of the poisonous alkaloids, which are absent in U. S. species. The taxonomy of Eurasian species is problematic as also the case for those in North America. ✿

REFERENCES

Calflora. My Calflora. Observations accessed 11/23/2023.

CCH2. Consortium of California Herbaria accessed 11/13/2023, *Ephedra foeminea*, det. S.M.Ickert-Bond 2007, originally identified *E. distachya*). Coll. R. N. Philbrick, Santa Barbara County, Santa Ynez Mtns: Trout Club, upper San Jose Crk below San Marcos Pass 1996-5-15 (2 specimens, 1 annotated).

CNPS Kern Chapter *Mimulus Memo.* Contributions by Richard Spjut, Sep 2014, Sep 2015.

Cutler H C 1939. Monograph of the North American species of the genus *Ephedra*. Ann. Missouri Bot. Gard. 26: 373–427

Eflora of India, photo of plant with fruit of *E. foliata*. ***https://efloraofindia.com/2013/12/26/ephedra-foliata/*** accessed 11/23/2023.

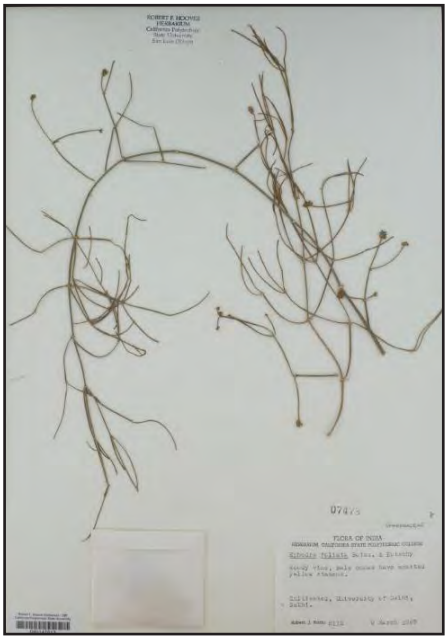
Faried A, A El-Banhawy, M Elqahtan 2018. Taxonomic, DNA barcoding and phylogenetic reassessment of the Egyptian *Ephedra* L. (Ephedraceae). Catrina 17(1): 1-17.

Flora of Qatar online – *E. foliata*: ***https://www.floraofqatar.com/ephedra_foliata.htm.***

Freitag H, M Maria-Stolte 1989. The *Ephedra* species of P. Forsskal. Taxon 38(4):545-556. Designated types for *E. aphylla* (neotype) and *E. foeminea* (lectotype) and compared *E. foliata* with *E. foeminea*, *E. aphylla*, and *E. fragilis*.

González-Juárez D E, A Escobedo-Moratilla, J Flores et al. 2020. A review of the *Ephedra* genus: Distribu-

Ephedra foliata Boiss. ex C.A. Meyer. **Below left**: Herbarium specimen at California State Polytechnic College from SEINet, label in lower right titled *Flora of India*, reported to have been collected by Robert J. Rodin 8112, 9 March 1967, "cultivated," "University of Delhi." **Below far right:** WBA herbarium specimen in part from plant in image on previous page showing the distinctive long-stalked cones. Specimen previously identified *Ephedra* cf. *pedunculata*, on WBA webpage, a species with vine-like growth that occurs in southern Texas and northern Mexico. **Lower center:** Photo of plant in part with seed covered by white fleshy bract from. *eflora of India*, *https://efloraofindia.com/2013/12/26/ephedra-foliata/*



tion, ecology, ethnobotany, phytochemistry and pharmacological properties. Molecules 2020, 25, 3283; doi:10.3390/molecules25143283.

Hollander J L, S B Vander Wall, J G Baguley 2010. Evolution of seed dispersal in North American *Ephedra*. Evol Ecol 24:333–345.

Huang J, D E Giannasi, R A Price 2005. Phylogenetic relationships in *Ephedra* (Ephedraceae) inferred from chloroplast and nuclear DNA sequences. Mol Phylogenet Evol 35:48–59.

Ickert-Bond S M 2012, Jepson Flora Project (eds.) 2023, Jepson eFlora, *Ephedra*. ***https://ucjeps.berkeley.edu/eflora/***, accessed on November 22, 2023. Additional note: No expert verified images found for *Ephedra foeminea.*

Ickert-Bond S M, C Rydin, S S Renner 2009. A fossil-calibrated relaxed clock for *Ephedra* indicates an Oligocene age for the divergence of Asian and New World clades and Miocene dispersal into South America. J Syst Evol 47:444–456.

Ickert-Bond S M, J J Skvarla, WF Chissoe 2003 Pollen dimorphism in *Ephedra* L. (Ephedraceae). Rev Palaeobot Palynol 124:325–334.

Ickert-Bond S M, M F Wojciechowski 2004 Phylogenetic relationships in *Ephedra* (Gnetales): evidence from nuclear and chloroplast DNA sequence data. Syst Bot 29:834–849.

JungleDragon. Accessed 11/24/23. "*JungleDragon is a nature and wildlife community for photographers, travellers and anyone who loves nature. We're genuine, free, ad-free and beautiful*." Images of *Ephedra foliata* in fruit, credited to Ori Fragman-Sapir.

JM2. The Jepson Manual, 2nd ed. 2012. *Ephedra* by S M Ickert Bond, also cited above).

Liguo Fu, F Li-kuo, Y Yongfu, H Riedl 1999. Ephedraceae. Flora of China 4: 97–101. 14 species

Loera I, V Sosa, S M Ickert-Bond 2012. Diversification in North American arid lands: Niche conservatism, divergence and expansion of habitat explain speciation in the genus *Ephedra*. Mol. Phylogenet. Evolut. 65, 437–450. doi: 10.1016/j.ympev.2012.06.025

Moe, L M 2016. Kern County Flora. CNPS, Sacramento CA.

Rydin C, R Blokzij, O Thureborn, N Wikström 2021. Node ages, relationships, and phylogenomic incongruence in an ancient gymnosperm lineage – Phylogeny of *Ephedra* revisited. TAXON 70, 701–719. doi: 10.1002/tax.12493

Rydin C, P Korall 2009. Evolutionary relationships in *Ephedra* (Gnetales), with implications for seed plant phylogeny. Int J Plant Sci 170:1031–1043.

SEINet accessed 2023-11-13. *Ephedra foliata:* 17 specimens, Rodin 8112, collected from cultivation in India.

Stevenson D W 1993. Flora North America (north of Mexico). Vol. 2: 428-434, 12 species.

Thoday (Sykes) M G, E M. Berridge 1912. The anatomy and morphology of the Inflorescences and flowers of *Ephedra*. Annals of Botany, VoL XX VL No. CIV.

Van Gelderen D M, J R P van Hoey Smith 1996. Conifers, 2 Vols. Timber Press Vol. 1. Image of *E. foliata.*

Villanueva-Almanza L, R M Fonseca 2011. Revisión tax-

A bisexual *Ephedra* plant. A rare occurrence found in a *E.* cf *viridis* plant collected in Squirrel Canyon. Male and female cones on the same plant and also one with both male (microsporangia) and female (1-2 seeds) flowers in the same cone; the male appear to have aborted development in producing pollen. Bisexual cones have been described for ***E. foeminea***: "*In* ***E. fragilis,*** var. ***campylopoda,*** [synonym], *the strobilus is bisexual, with male flowers in the axils of the lower pairs of fertile bracts and ovules in the axils of the uppermost pair. The latter, however, never reach full development.*" (Thoday and Berridge 1912).

onómica y distribución geográfica de *Ephedra* (Ephedraceae) en México. Acta Botanica Mexicana 96: 79-116. 9 species, one endemic to Mexico.

Yang Y, Q Wang 2013. The earliest fleshy cone of *Ephedra* from the Early Cretaceous Yixian Formation of Northeast China. PLoS ONE 8(1): e53652. doi:10.1371/journal.pone.0053652

Wikipedia. *Ephedra*. Accessed 11/23/2023. Map showing geographical distribution.

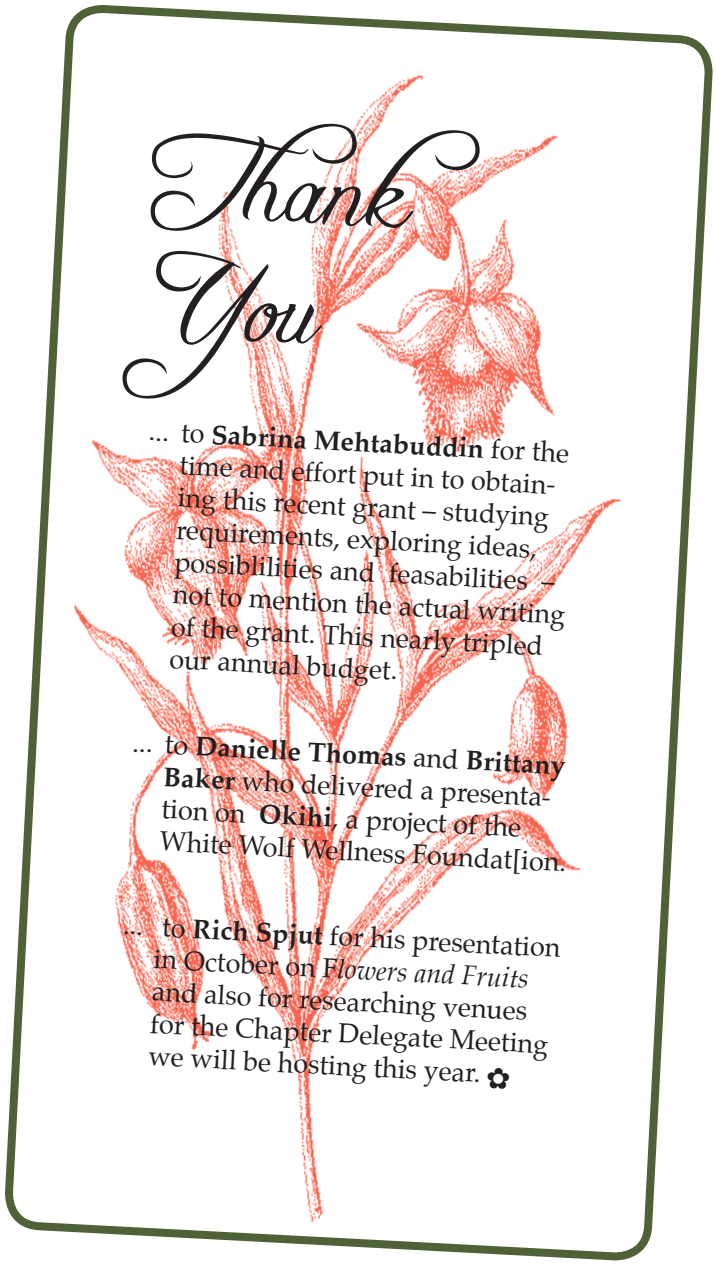
World Botanical Associates. Trees and shrubs of Kern County—*Ephedra*. ***http://www.worldbotanical.com/ephedra.htm***. Accessed 11/22/23. Note: Erskine Creek *Ephedra* identified *E.* cf. *pedunculata* to be revised to *E. foliata*.

ENDNOTES

[1] Cf. Note: cf. is a standard abbreviation for "confer" or "compare", used in this contribution when the author considers the plant could be a a different species.

[2] Palynodata, a palynological data on fossilized pollen has numberous reports on *Ephedra* pollen from Tertiary deposits in the southeastern U.S.

[3] A. S. Foster (1972) who published on **Venation patterns in the leaves of *Ephedra*.** (J. Arn. Arb. 53: 364-78), reportedly collected live "shoots" of *E. foliata* from the UC Berkeley Botanical Garden, and also used U C Herbarium specimens; however the garden database does not currently list the species. Similarly, San Marcos Growers Nursery in Santa Barbara once reported cultivating *E. foliata*, but their database only lists *E tweedieana*, a South American species similar in habit and fruit to *E. foliata* but differing in seedcones being sessile. It seems likely that both these species along with *E. foeminea* are cultivated in California.



Found in the News:
"Flowers 'giving up' on scarce insects and evolving to self-pollinate"

Excerpted and abridged from The Guardian *12-20-23*

A STUDY HAS FOUND THAT THE FLOWERS OF FIELD PANSIES GROWING NEAR PARIS ARE 10% *SMALLER and produce 20% less nectar than flowers growing in the same fields 20-30 years ago. They are also less frequently visited by insects."*

The millenia-long relationship linking flowers and pollinators may be eroding due to the decline in pollinators over the last 50 years. Flowering plants appear to be evolving to not need pollinators and to rely on self-pollination. Other plants which have difficulty switching to self pollination seem to be trying other tactics, like producing more pollen for the fewer number of pollinators visiting them.

Article: ***https://www.theguardian.com/environment/2023/dec/20/flowers-giving-up-on-scarce-insects-and-evolving-to-self-pollinate-say-scientists***

Original Study: ***https://nph.onlinelibrary.wiley.com/doi/full/10.1111/nph.19422.*** ✿