



## *Ephedra chengiae* (Ephedraceae), a new species from Xizang of China

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**ABSTRACT:** A new species of Ephedraceae, i.e. *Ephedra chengiae* sp. nov., is described and illustrated here. This new species is similar to *E. rituensis* Y. Yang & al. and *E. intermedia* Schrenk & C.A. Mey. in the erect habit with prominent woody stems, elongated twigs with many nodes, and the long micropylar tube. However, it differs from *E. rituensis* by the synangia being prominently stipitate (vs. sessile), the female cone having fewer bract pairs (3–4 vs. 4–5), its glossy seeds, and from *E. intermedia* by the prominently stipitate synangia (vs. sessile or nearly so), the female cone having fewer bract pairs (3–4 vs. 2–5), the glossy seeds (vs. seeds not glossy), and the micropylar tube being more or less straight (vs. twisted). *Ephedra chengiae* var. *spinosa* var. nov. differs from var. *chengiae* in its cushion-like habit and the spinose twigs.

**KEY WORDS:** China, *Ephedra rituensis*, *Ephedra intermedia*, Ephedraceae, morphology, new species, taxonomy, Xizang.

### INTRODUCTION

*Ephedra* L., the only living genus of the family Ephedraceae, contains more than 60 species that are widely distributed in cold and arid places in the Northern Hemisphere and South America. Jin and Yang (2015) recorded 16 species from China in a recent species catalogue, among them six species are distributed in Xizang, i.e. *E. gerardiana*, *E. intermedia*, *E. likiangensis* Florin, *E. monosperma*, *E. rituensis*, and *E. saxatilis*.

The Herbarium (PE) of Institute of Botany, the Chinese Academy of Sciences organized an expedition team which collected specimens in Xizang of China for a number of years. These field collections resulted in many new specimens being added to the Herbarium. The senior author was asked to identify these new specimens from time to time, and a few specimens from western Xizang drew his attention a few years ago. These specimens consist of both male and female reproductive shoots and were beautifully prepared, so that it was possible to observe important taxonomic characters in detail. The authors can determine now that these specimens belong to a new species. This species possesses an erect habit with prominent woody stems and spreading branches and twigs, shows similarity to *E. rituensis* Y. Yang & al., *E. intermedia* Schrenk & C.A. Mey. and *E. saxatilis* (Stapf) Royle ex Florin, but is markedly different from the dwarf habit of *E. gerardiana* Wall. ex Klotzsch & Garcke and *E. monosperma* J.G. Gmel. ex C.A. Mey. in the same area. Further study revealed a few characters not seen in the three similar species, e.g. the prominently stipitate synangia, the glossy seeds, and the long straight micropylar tube. As a result, the authors formally describe this species here.

### MATERIALS AND METHODS

Morphological characters of the new species were gleaned from herbarium specimens and ecological photos taken by one of the collectors (X.T. Ma). Morphological characters of comparable species were obtained and extracted from published works (Hooker, 1886; Cheng, 1978; Fu *et al.*, 1999; Yang *et al.*, 2003; Sharma and Singh, 2016). A morphological species concept was adopted in this paper, and was treated as the minimal taxon possessing morphological continuity within a species and morphological discontinuity between species. Geo-coordinates were obtained from the field notes of the herbarium specimens. Ecological photos and illustrations were edited and adjusted in Adobe Photoshop CS2 (vers. 9.0). A distribution map was generated using the software ArcGIS (ver. 10.2).

### TAXONOMIC TREATMENT

*Ephedra chengiae* Y. Yang & D.K. Ferguson, *sp. nov.*

誠氏麻黃 Figs. 1–2

**Type:** CHINA. Xizang: Zanda Xian, 31°34'08"N, 79°51'05"E, desert grasslands on plateau, alt. 4233 m, 19 July 2013, *PE Xizang Exped. 3700* (holotype: PE02345113; isotypes: PE02345114, PE02345115).

**Diagnosis:** This species is similar to *Ephedra rituensis* Y. Yang *et al.* and *E. intermedia* Schrenk & C.A. Mey. in the long micropylar tube, but differs from the latter two species by the stipitate synangia (vs. sessile synangia), female cones having fewer pairs of bracts (3–4 vs. up to 5), and the glossy seeds (vs. seeds not glossy).

**Description:** Dioecious shrub, up to 36 cm tall (Figs. 1A, 2A–B). Woody stems robust, up to 8 mm in diam., rarely branched, having twigs clustered at the top of the woody stems or at least upper portion of the woody stems;

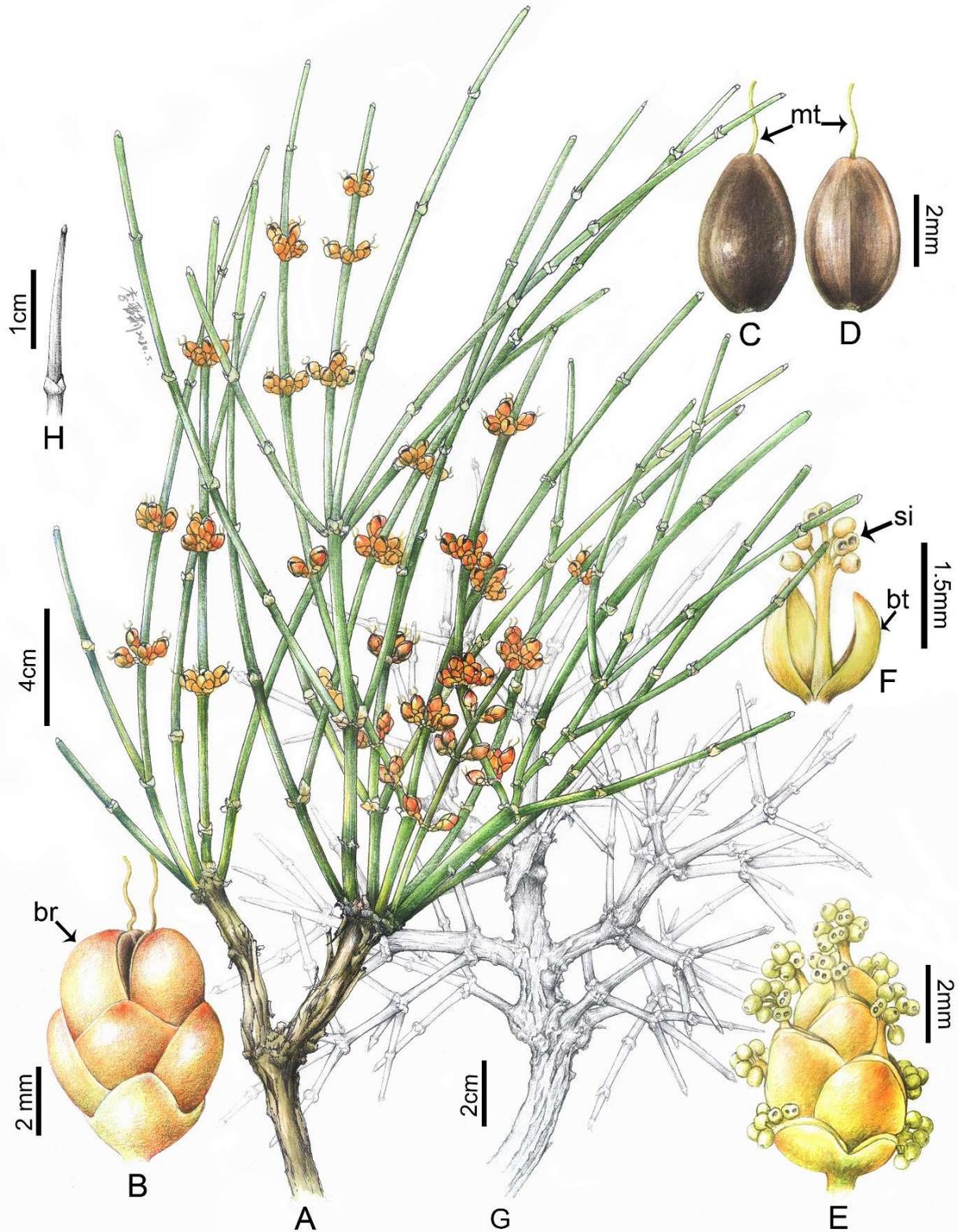


Fig. 1. Illustrations of *Ephedra chengiae* sp. nov. (A-F) and var. *spinosa* var. nov. (G-H); A, a plant displaying the erect habit; B, a female cone showing the fleshy bracts and the enclosed chlamydosperms; C & D, chlamydosperms displaying the ovoid-ellipsoid shape and the long and straight micropylar tube; E, a male cone revealing the exposed synangia with apical openings; F, a pair of bracteoles subtending a median synangiophore with terminal stipitate synangia; G, a plant of var. *spinosa* exhibiting the cushion-like habit and the spinose twigs; H, a twig displaying the spinose shape. Abbreviations: br, bracts; bt, bracteoles; mt, micropylar tube; si, synangium.



Fig. 2. Ecological photos of *Ephedra chengiae* sp. nov. displaying habit and habitat. **A**, female plant; **B**, male plant.



Fig. 3. Distribution map of *Ephedra chengiae* sp. nov. (square) and var. *spinosa* (triangle).

bark grey, fibrous, longitudinally fissured (Fig. 1A). Branches thickened. Twigs greenish to yellowish green, noded, usually not branched or branched only once; nodes enlarged, usually having two brown leaves fused laterally into a white membranous leaf sheath when young, but caducous and leaving greyish black scars at the nodes; internodes longitudinally furrowed, 1.5–5 cm long, 1–2 mm in diam. Female cones opposite or clustered at nodes, sessile, ovoid, ellipsoid to subglobose, ca. 5–7 × 4 mm; bracts 3–4 pairs, possessing membranous margin, entire, basal pairs minimum in size, getting larger distally, the uppermost pair twice as large as the middle pair, fused for ca. 1/2 of their length, apex obtuse; red and fleshy when ripe (Fig. 1B). Chlamydosperms enclosed, ovoid to ellipsoidal, convex dorsally and flat ventrally, 4–5 mm long, 3–4 mm broad, black, glossy (Figs. 1C–D); micropylar tube usually straight, slightly curved, ca. 2 mm long (Figs. 1C–D). Male cones yellow, sessile, 5–7 mm long, ca. 4 mm in diam.; bracts 3 or 4 pairs (Fig. 1E); male reproductive units consisting of a basal pair of bracteoles and a central synangiophore (Fig. 1F); each synangiophore usually having 6 synangia at the apex; synangia prominently

stipitate (Fig. 1F). Male and female reproducing in July.

**Etymology:** The specific epithet is derived from Ching-Yung Cheng for her contributions to taxonomic knowledge of Chinese gnetophytes. Prof. Cheng was the author of the *Chlamydospermopsida* in *Flora Reipublicae Popularis Sinicae* (Cheng, 1978).

**Habitat:** The species lives in rock crevices or on slopes of sand dunes.

**Distribution:** The species is distributed in western Xizang of China (Fig. 3, black solid square).

**Other specimens examined:** CHINA. Xizang: Burang Xian, 30°12'47.0"N, 81°13'56.3"E, grasslands on slope, alt. 3910 m, 20 July, 2013, *PE Xizang Exped. 3776* (PE02345116, PE02345117, PE02345118).

**Conservation:** We have specimens collected from two localities in Xizang of China, but have no population dynamic information. As a result, we prefer to list this species as DD according to the *IUCN Red List Categories and Criteria: Version 3.1* (IUCN, 2012).

*Ephedra chengiae* var. *spinosa* Y. Yang & D.K. Ferguson, *var. nov.*

刺枝麻黄 Figs. 1G–H

**Type:** CHINA. Xizang: Shannan City, Lhozhag County, Lhakang Town, 28°6'39.49"N, 91°7'21.64"E, alt. 3600 m, ripe female cone red, 15 Sept. 2017, *PE-Xizang Exped. 6702* (holotype: PE02333692; isotypes: PE02345119, PE02345120).

**Diagnosis:** The new variety differs from *E. chengiae* var. *chengiae* in the dwarf and cushion-like habit, straight and spinose twigs with 1–2 internodes (vs. erect shrub, twigs not spinose with more than 3 nodes).

**Etymology:** The specific epithet is derived from the spinose twigs.

**Distribution:** This new variety is only known from Lhozhag County of Xizang in China (Fig. 3, triangle).

**Conservation:** We have no population dynamic information about var. *spinosa*. Hence, we prefer to list this species as DD according to the *IUCN Red List Categories and Criteria: Version 3.1* (IUCN, 2012).

**Notes:** This new variety obviously belongs to *E. chengiae*

**Table 1.** A comparison of morphological characters between *Ephedra chengiae* sp. nov. and similar species from Xizang of China.

Characters	<i>E. chengiae</i>	<i>E. gerardiana</i>	<i>E. intermedia</i>	<i>E. likiangensis</i>	<i>E. monosperma</i>	<i>E. rituensis</i>	<i>E. saxatilis</i>
Habit	erect shrub	compact shrub	shrub	shrub	herb-like	shrub	shrub
Height (cm)	up to 36	up to 15	up to 100	up to 150	up to 15	up to 50	up to 60
Twig nodes	>3	1–3	>3	>3	1–3	>3	>3
Twig internode length (cm)	1.5–5	1–2	2–6	2–4	1–3	1.4–3.9	2–4
Male cones: bract pairs/whorls	3–4	3–6	3–4	4–6	2–3	3–4	5–6
Synangium stalked	prominently stalked	sessile	sessile	sessile	sessile	sessile	sessile
Female cone: bract pairs/whorls	3–4	2 or 3	2–5	2–3	2–3	4–5	2–3
Seed number	2	(1–)2	2–3	1–2	1	2	(1–)2
Seed length (mm)	4–5	4–6	5–6	4.5–8	3.5–6	5	6
Seed glossy	yes	no	no	no	no	no	no
Micropylar tube	straight or nearly so	straight	strongly twisted	straight	slightly curved	straight or nearly so	straight
Micropylar tube length (mm)	2	1	3–5	<1	1.5–2	2.2	0.5

because the sessile female cone usually has two black glossy seeds each of which has along and straight micropylar tube, but it differs from *E. chengiae* var. *chengiae* in its dwarf and cushion-like habit, and the straight and spinose twigs with 1–2 nodes.

## DISCUSSION

According to the classification of Mussayev (1978), the six species from Xizang can be divided into two groups: subsect. *Ephedra* including *E. intermedia* and *E. rituensis*, and subsect. *Monospermae* Pachom. comprising *E. gerardiana*, *E. likiangensis*, *E. monosperma*, and *E. saxatilis*. Our new species belongs to subsect. *Ephedra* in that classification; it is similar to *E. rituensis* in general habit, the sessile male and female cones, and the long and straight micropylar (or nearly so) tube, but differs by its stipitate synangia, the female cone having fewer pairs of bracts (3–4 vs. 4–5), the fusion of the uppermost pair of bracts (1/2 vs. 1/3–1/2), and the glossy seeds. The new species is also similar to *E. intermedia* in its erect woody habit, profuse branching, and the long micropylar tube, but differs from the latter by the synangia being prominently stipitate (vs. sessile or nearly so), the female cone having fewer pairs of bracts (3–4 vs. up to 5), and its glossy seeds (vs. not glossy), the micropylar tube straight or nearly so. A comparison of our new species and the six species in Tibet is tabulated in Table 1.

*Ephedra yangthangensis* P.Sharma & R.Singh is a species recently described from northern India (Sharma and Singh, 2016). It is similar to *E. intermedia* and characterized by long and twisted micropylar tubes and yellowish orange bracts when ripe. Our new species differs from *E. yangthangensis* by the red bracts when ripe (vs. yellowish orange bracts), its stipitate synangia (vs. sessile), and the straight (or nearly so) micropylar tube.

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