

THE *EPHEDRA*-SPECIES OF P. FORSSKÅL: IDENTITY AND TYPIFICATION

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Summary

The names of the two *Ephedra*-species validly published in P. Forsskål's *Flora aegyptiaco-arabica* are typified: *E. aphylla* Forssk. by means of a neotype, and *E. foeminea* Forssk. by designation of a lectotype. Arguments and details in support of the decisions are provided. Hitherto, *E. aphylla* has usually been called *E. alte* C. Meyer. The type material of the later published *E. alte* is in fact a mixture of *E. aphylla* (male specimens) and *E. foliata* Boiss. ex C. Meyer (female specimens). *Ephedra foeminea* also has priority against *E. campylopoda* C. Meyer. The species and their closer relatives are compared with respect to their morphology, ecology and distribution.

Introduction

In revising the genus *Ephedra* from SW Asia it was essential also to consider the species from the E Mediterranean described or mentioned by P. Forsskål in his *Flora aegyptiaco-arabica* (1775). This flora antedates the monographs of Meyer (1846) and Stapf (1885), and the most relevant publications of Boissier, the *Diagnoses* . . . (1842–1859) and the *Flora orientalis* (1867–1888). Therefore, besides the more historical interest in the three species mentioned for the first time from the area, the identity and the nomenclatural problem of priority for the two species described by P. Forsskål needed to be checked. With regard to the latter, the authors consider the species described in the second part of the *Flora aegyptiaco-arabica* as validly published. For the controversy which has arisen about them from an extremely strict interpretation of the Art. 23 of the International Code of Botanical Nomenclature (Voss et al., 1983) by Burdet and Perret (1983) see Greuter (1984), Friis et al. (1984), and Jeffrey (1985).

The *Ephedra*-Species of the Flora Aegyptiaco-Arabica

In the first part of the book, where the plants collected by the expedition in the different regions are listed, three species of *Ephedra* are cited: *E. foeminea* (Fig. 1A), *E. distachya*, and *E. aphylla* (Fig. 1B). In the second part of the *Flora aegyptiaco-arabica*, the “Centuria”, the two new species *Ephedra aphylla* and *E. foeminea* are described (Fig. 1C and 1D).

From the original Forsskål herbarium, apparently only five specimens of *Ephedra* have survived, three in C and two in BM. They all belong to *E. foeminea*. The curators of all other herbaria cited in Stafleu and Cowan (1976) as housing at least some Forsskål-specimens were unable to locate any sheets. Also, F. N. Hepper (in litt.) stated that he has not seen any further material either. The descriptions of the two new species include many important details and give full evidence of P. Forsskål's excellent morphological observations. In our opinion, both species must be considered as validly published, although in *E. aphylla* no type material has survived, and even in spite of the question mark behind the specific epithet of *E. foeminea*. The latter case clearly comes within the provision of Art. 34.2 of the Code (Voss et al., 1983, p. 34) with the statement “Art. 34.1(a) (not validly published) does not apply to names with a question mark or other indication of taxonomic doubt, yet published and accepted by the author”. The publication of the *Flora aegyptiaco-arabica* antedates all other descriptions of the respective taxa, and as no reasons for rejecting

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A

440. (●) *EPHEDRA fœminea*. Imr.

B

535. *EPHEDRA a) distachya*. - Cd. *Oqqair*. عقيض vel *Alde*. علد
 535. - - *b) aphylla*. - Rs. (cfr. Cent. VIII. 96.)

C

64. *EPHEDRA APHYLLA*; ramis patentissimis.

DESCR. *Caulis* teres, planatus, articulatus, subdichotomus, glaber, non sulcatus, aphyllus, crassitie pennæ columbinæ, articulis sesquipollicaribus; non lignosus, sed coriaceo-spongiosus, viridis, diffusus, altissime scandens.

Rosetta in sepibus altissimis. Græc. Σπάγλα. Nominis similitudo *Spartium diadelphum* non evincit; quumque flores non vidi, convenientiam memini cum planta ejusdem formæ in insula Imros quondam inventa, quam *Ephedram* putavi; forsitan vero in utraque deceptus sum.

D

96. *EPHEDRA FÆMINEA*?

DESCR. *Frutex* aphyllus. *Rami* similes *Equiseti* vel *Ephedræ*. *Pedunculi* oppositi; interdum ex altera ala unicus; ex altera 3 vel 4 umbellatim. *Amenta* non aderant; nam pedicelli omnes ex ala prodeunt vel solitarii; vel umbellati. Rarissime ex uno articulo 4 rami verticillatim exhibant. *Flores* fœmineos tantum inveni; *styli* 2. *Semina* 2.

In Insula Imros, *Pyrum* scandebat caule non volubili, sed totam coronam arboris implicabat, (cfr. Cent. VI. 64.)

Fig. 1. Citations of *Ephedra*-species in the *Flora aegyptiaco-arabica*: A. *Flora Constantipolitana, littoris ad Dardanellos et insularum Tenedos, Imros, Rhodi*, p. XXXV. Here the asterisk indicates that the species is described in the "Centuria", and the locality Imr. refers to Imroz, today Gökçeada, a Turkish Island at the western entrance of the Dardanelles. B. *Flora aegyptiaca*, p. LXXVII. The abbreviations are explained on p. L as follows: "Cd.—Cairi vel Káhiræ loca deserta", and "Rs.—Rosettae spontaneae", today Rashid, near the mouth of the W branch of the river Nile. C. "Centuria VI", p. 170. D. "Centuria VIII", p. 219.

them can be seen, the Forsskål-names should be applied, irrespective of the names presently in use and the legitimate interest in stabile names.

The Identity of P. Forsskål's Ephedra-Species

1. Ephedra aphylla

Nomenclatural History

C. A. Meyer (1846), the first monographer of the genus *Ephedra*, included *E. aphylla* in his "species non satis notae" under no. 20 (pp. 291–292). He cited the full protologue of Forsskål without giving any further detail or comment. Boissier (1884) did not mention the species. Stapf (1885) put it into the synonymy of *E. alte*. C. Meyer, a species based on rich material collected by Schimper from the lower parts of Jebel Musa in Sinai. All later authors up to Zohary (1966) and Riedl (1969) followed Stapf. Only in recent times, with

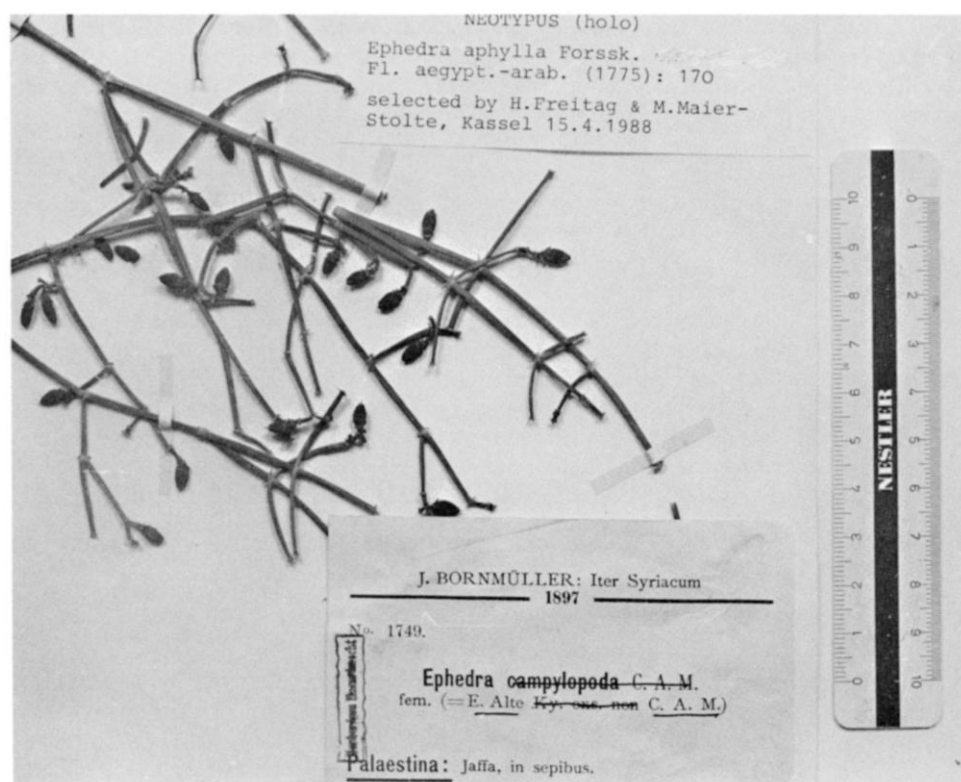


Fig. 2. The neotype of *Ephedra aphylla* Forssk. in JE; detail.

growing awareness of the principle of priority, the name *E. aphylla* has been reapplied, first by Danin and Hedge (1973) after a suggestion by Miss Hillcoat of BM, and then in all relevant floras and plant lists of the area, including Greuter et al. (1984). Contrary to Stapf, modern authors consider *E. alte* as a synonym of *E. aphylla*. However, this is not fully justified.

Identification

The identification of *E. aphylla* seemed to be more difficult because of the loss of type material and the fact that the description refers to sterile individuals only. Also the attempt of the first author to re-collect the species around the type locality at Rashid failed. Nevertheless, there can be no doubt about its identity. Already Danin and Hedge (1973) have drawn the conclusion from the list of localities in Täckholm and Drar (1941) that within the wider area of Rosetta (Rashid) only one species of the genus occurs which must be the same one that P. Forsskål had collected. After having seen most of the *Ephedra* material ever collected in Egypt and adjacent countries we can confirm this statement for the whole coastal area from Libya to Palestine.

The descriptions of the growth form as “altissime scandens” and the habitat “sepibus altissimis” look somewhat strange. According to our eco-morphological studies carried out on populations at several localities, and in accordance with most of the scattered data from the labels of herbarium specimens, the *Ephedra* species from coastal Egypt grows in semi-deserts or in wadi beds on rocky soils or even in cliffs. It reaches not more than 0.8-1.4 m in height and has several overhanging stems and main branches. But the species has

occasionally been collected also from secondary habitats in hedges along irrigation ditches. Owing to abundant water supply, shade and the presence of supporting stems and branches of other woody plants, such individuals behave like scandent lianas. They produce more delicate and looser branch systems and agree completely with Forsskål's description.

Typification

As no original material exists, the specimen which fits best into the requirement and recommendations of the Code has been selected as neotype:

Bornmüller 1749, Iter Syriacum, (Israel) Jaffa, in sepibus. 12.5.1897 (sub) *E. campylopoda* C. A. Meyer, fem. (ale). Neotype: JE; Isoneotypes: BM, G, W.

The specimen (Fig. 2) exhibits the diffuse branching pattern and the scandent habit mentioned in the diagnosis as being similar to *E. foeminea*. It has been collected from the same habitat type (hedges), represents female material which in this special case is more significant than male material, and isotypes are distributed among several herbaria, probably more than mentioned above. Furthermore, the female type material is conveniently completed by the corresponding male specimens, collected as *Bornmüller 1746* at the same date and locality. They are preserved in BM, JE, K, WU and G, in the latter herbaria mounted together with female material of the isotypes.

Comments on Distribution and Related Species

Most specimens from the S Mediterranean identified by previous authors as *E. alte* in fact belong to *E. aphylla*. However, some specimens from the southern part of the Sinai peninsula including all seen female syntype-material of *E. alte* (*Schimper 280*: CGE, G, GOET, K, NY, WU; *Schimper 316*: E, G, NY, belong to *E. foliata* Boiss. ex C. Meyer (= *E. ciliata* C. Meyer) instead. They have much longer leaves on the innovation shoots (up to 10 mm in the material from G, Fig. 3) and sometimes even on the flowering branches, rather long and branched cone-bearing twigs and usually 2-seeded female cones of ovate shape. Confusingly, the male syntypes of *E. alte* (*Schimper 280*: CGE, E, G, GOET, K, NY, WU; *Schimper 316*: B, BM, CGE, E, G) belong to *E. aphylla*. Both numbers of Schimper include male and female material from the two classical localities "Bestan ad radices montis Sinai" and "rupes vallis Raphidim", but in all probability the male and the female material was collected each at one locality only, and later on mixed up. This interpretation is backed by the different collecting dates (24.5.1835 and 20.7.1835, respectively) and the corresponding phenological stages with the male material being in full flower and the female carrying mature seeds.

Full descriptions will be given in the later revision, but for convenience the most important differential characters of both species and others discussed here are listed in Table 1 and illustrated in Fig. 4. Appropriate illustrations of *E. aphylla* and *E. foliata* are given in Zohary (1966, pl. 21 sub *E. alte* and pl. 23 sub *E. peduncularis*, respectively).

Both the SE Mediterranean *E. aphylla* (Map 1) and the pluriregional Irano-Turanian, Saharo-Arabian and Nubo-Sindian *E. foliata* (Map 2) belong to sect. *Pseudobaccatae* Stapf and the tribe Scandentes Stapf. They have a somewhat similar general appearance and, in the occasional absence of the typical filiform leaves, sterile specimens of the latter and even male branches can easily be mistaken for *E. aphylla*.

Still closer related to *E. aphylla* are *E. fragilis* Desf. and *E. foeminea* Forssk. (= *E. campylopoda* C. Meyer). The W Mediterranean *E. fragilis*, which differs mainly by the high number of stamens (4–6 versus 3–4), the brown pith parenchyma, and the easily disarticulating branches (in dry condition), meets *E. aphylla* only at the Libyan coast (Map 1). The E Mediterranean *E. foeminea* is characterized by 2-seeded female cones and by absence of cilia from the leaf sheaths and the margin of the bracts. The distributional areas of *E. aphylla* and *E. foeminea* seem to overlap from Sinai up to Lebanon, but in fact both species are clearly separated ecologically: *E. aphylla* occurs in arid and semiarid regions

Table 1. Main differential characters of the two *Ephedra*-species of P. Forsskal and their closest relatives.

	<i>E. fragilis</i>	<i>E. aphylla</i>	<i>E. foeminea</i>	<i>E. foliata</i>
Growth form, habit	usually ± erect	usually ± erect	usually scandent	usually scandent or almost decumbent
Disarticulation of dry stems	pronounced	slightly	slightly	slightly
Colour of pith-parenchyma	brown	usually whitish	whitish	whitish
Total length of leaves including sheaths (mm)	up to 2	up to 3	up to 2.5	up to 10–15(40)
Margin of leaf sheaths and bracts	ciliate	ciliate	glabrous	ciliate
Position of female cones		usually whorled or paired on last year's twigs		usually on long, loosely-branched, this year's twigs
Peduncles of female cones	straight	straight	usually conspicuously curved	usually straight
Shape of immature female cones	narrow cylindrical	narrow cylindrical	narrow cylindrical	ovate (even in the case of the 1-seeded cones)
Number of seeds per cone	1(2)	1(2)	(1)2	(1)2(3)
Number of anthers per flower	4–6	3–4	4–6	3–4
Bioclimatological affinity	semiarid to arid	semiarid to arid	semihumid	semiarid to arid

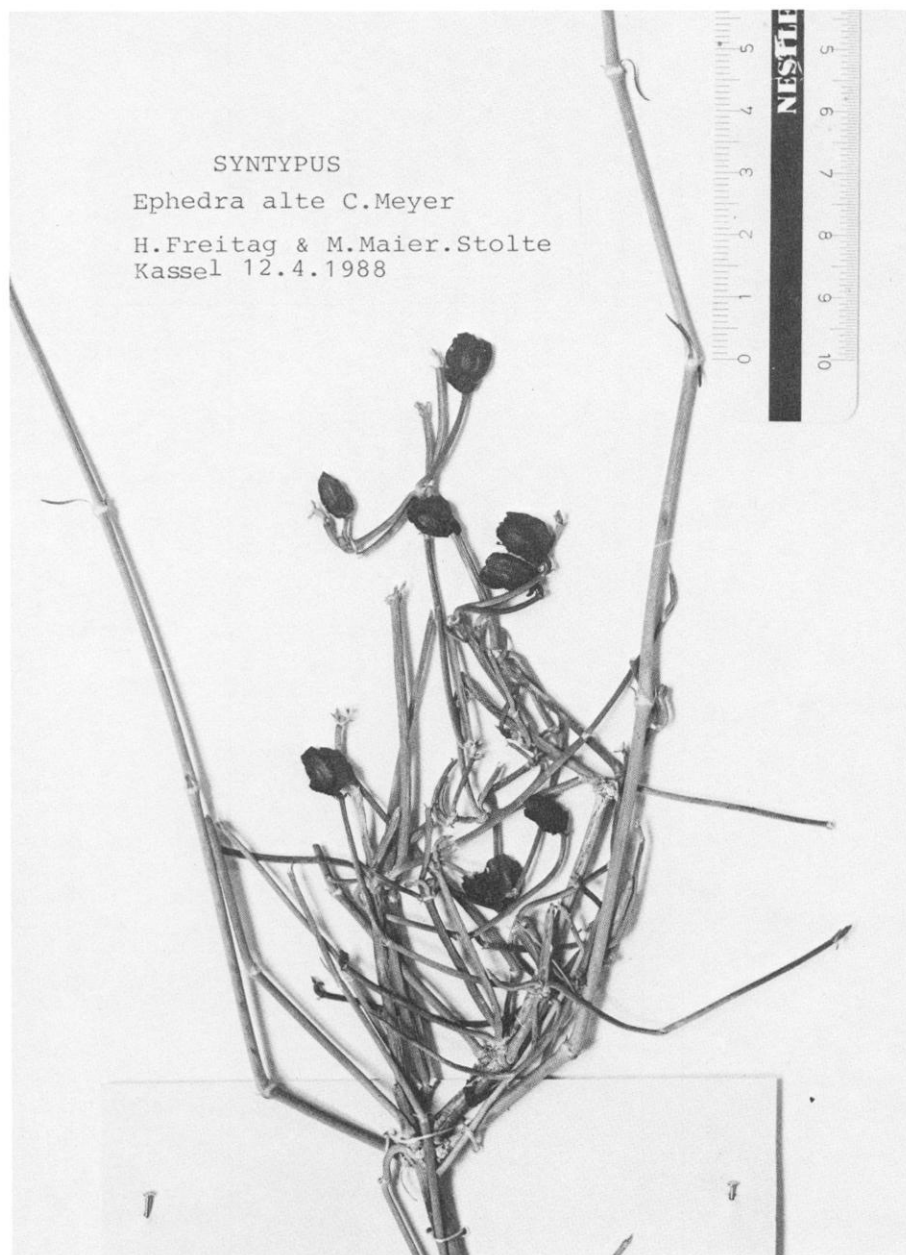


Fig. 3. A syntype of *Ephedra alte* C. Meyer (= *E. foliata* Boiss. ex C. Meyer) in G; detail of *Schimper* 316, Bestan.

only, whereas *E. foeminea* is restricted to semihumid areas in the montane zone or to corresponding more humid local habitats.

2. *Ephedra foeminea*

Nomenclatural History

The case of *E. foeminea* is much simpler. The Forsskål name was ignored by Meyer (1846) and Boissier (1884), probably because of the question mark behind it. Stapf (1885)

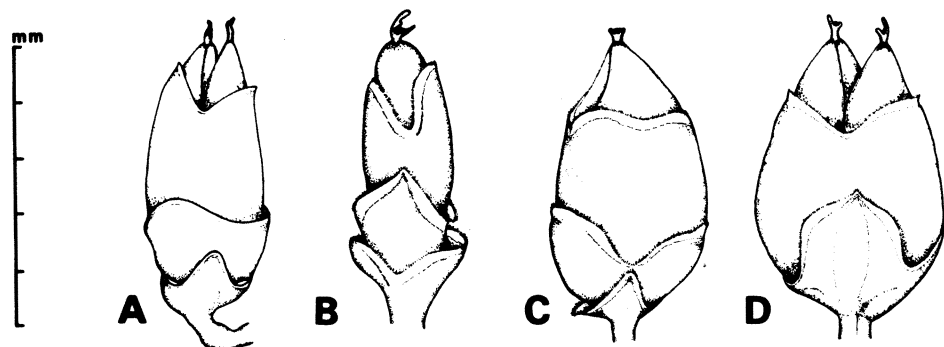
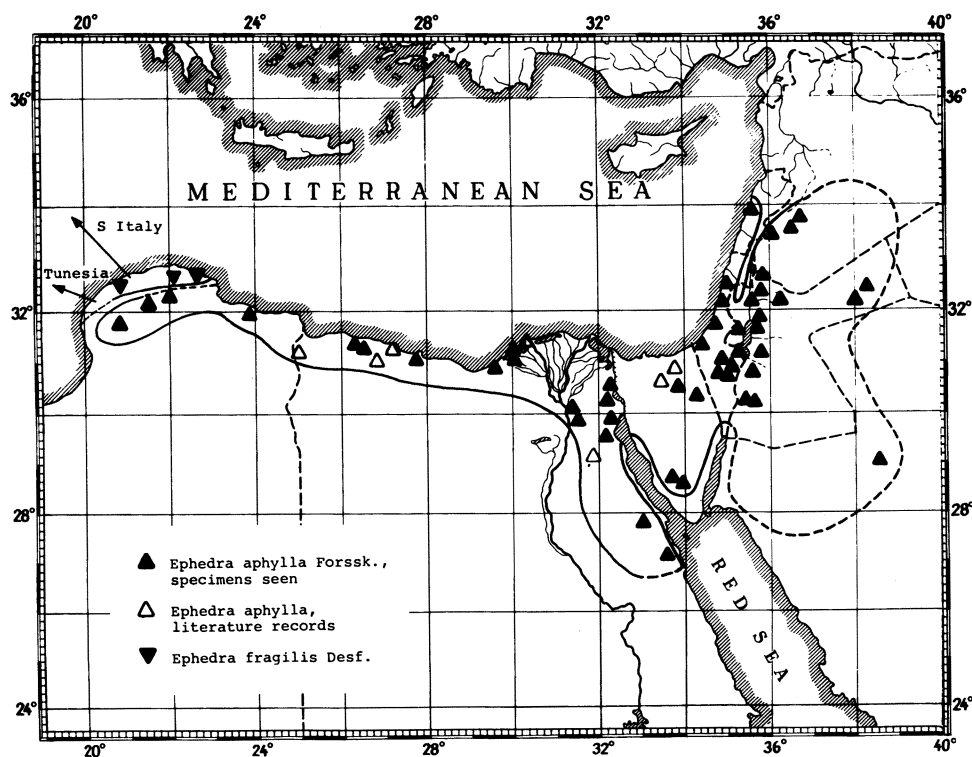
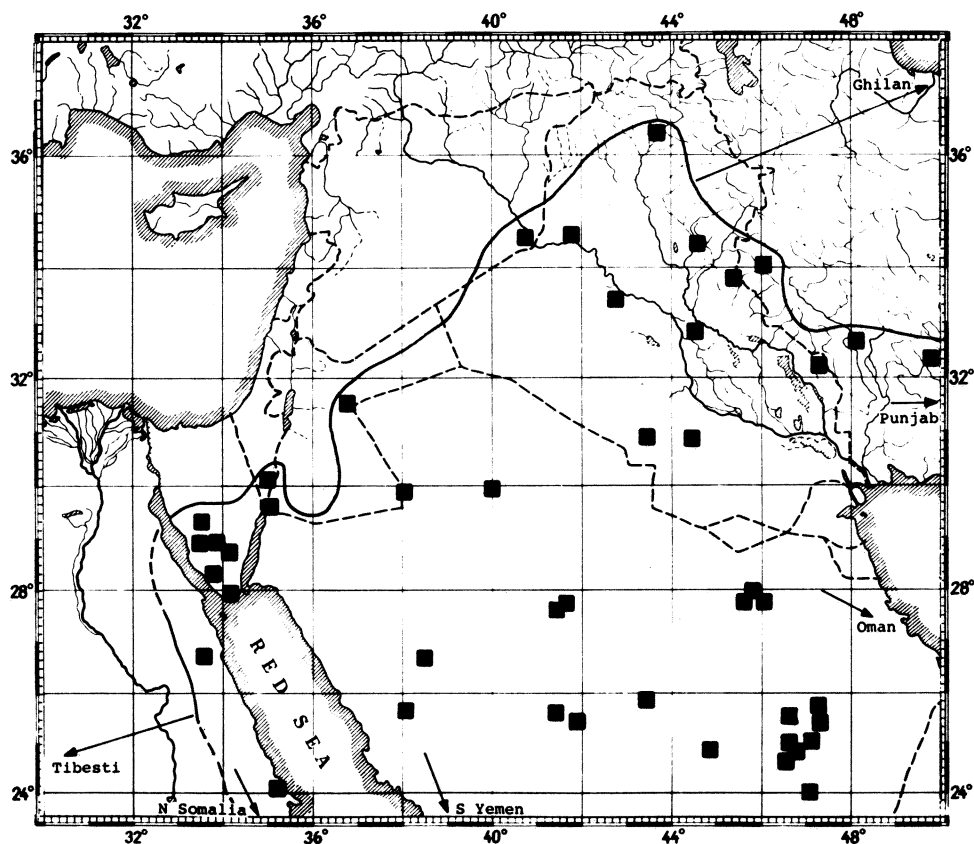


Fig. 4. Female cones of some *Ephedra* species. A. *E. foeminea* Forssk. B. *E. aphylla* Forssk. C–D. *E. foliata* Boiss. ex C. Meyer, 1- and 2-seeded.

saw the original material and stated its identity with *E. campylopoda* C. Meyer, a species described on the basis of several syntypes from Dalmatia to Crete. He put it into the synonymy of the latter taxon considered by him as a variety of the W Mediterranean *E. fragilis* Desf. Richter (1890) formally raised the variety to subspecific rank. In later floras and relevant literature the taxon is usually cited as *E. campylopoda* (e.g., Rechinger, 1943; Coode and Cullen, 1965; Zohary, 1966; Greuter et al., 1984), or, more rarely, as *E. fragilis* subsp. *campylopoda* (e.g., Markgraf, 1964; Meikle, 1977). Later confirmations of the iden-



Map 1. Distribution of *Ephedra aphylla* Forssk. The literature records refer to Täckholm and Drar (1941).



Map 2. Distribution of *Ephedra foliata* Boiss. ex C. Meyer in NE Africa and the Near East.

tity of *E. foeminea* with *E. campylopoda* based on the Forsskål-material are from Christensen (1922) and Hepper (1985, in schedis).

Identification

The five existing specimens of *E. foeminea*, probably having been collected from the same plant, agree in every respect with P. Forsskål's accurate description of a female individual. Furthermore, they agree very well with the material of *E. campylopoda* seen by the authors. Of special diagnostic importance are the female cones: 2-seeded, almost narrow cylindrical before becoming fleshy at full maturity, on short, curved peduncles. Further differential characters are the absence of cilia from the margins of bracts and leaf sheaths, the whitish pith-parenchyma, and the scandent habit. In addition, *E. campylopoda* is the only species of the genus reported to occur in the coastal areas of the Aegean Sea.

Typification

From the three specimens preserved in C, the Herbarium Forssk. no. 794, IDC microfiche 41, III, 1–2, has been designated as the lectotype (Fig. 5). It is the only one with an original small Forsskål label on the backside, with the following four words, each in a separate line: "*Ephedra distachya? femina* Imros". The two remaining specimens in C are considered to represent isoelectotypes. From the lack of the stamp "Herb. Forssk. no." and of identification labels of Stapf, it is concluded that they were filed in the general herbarium and have only

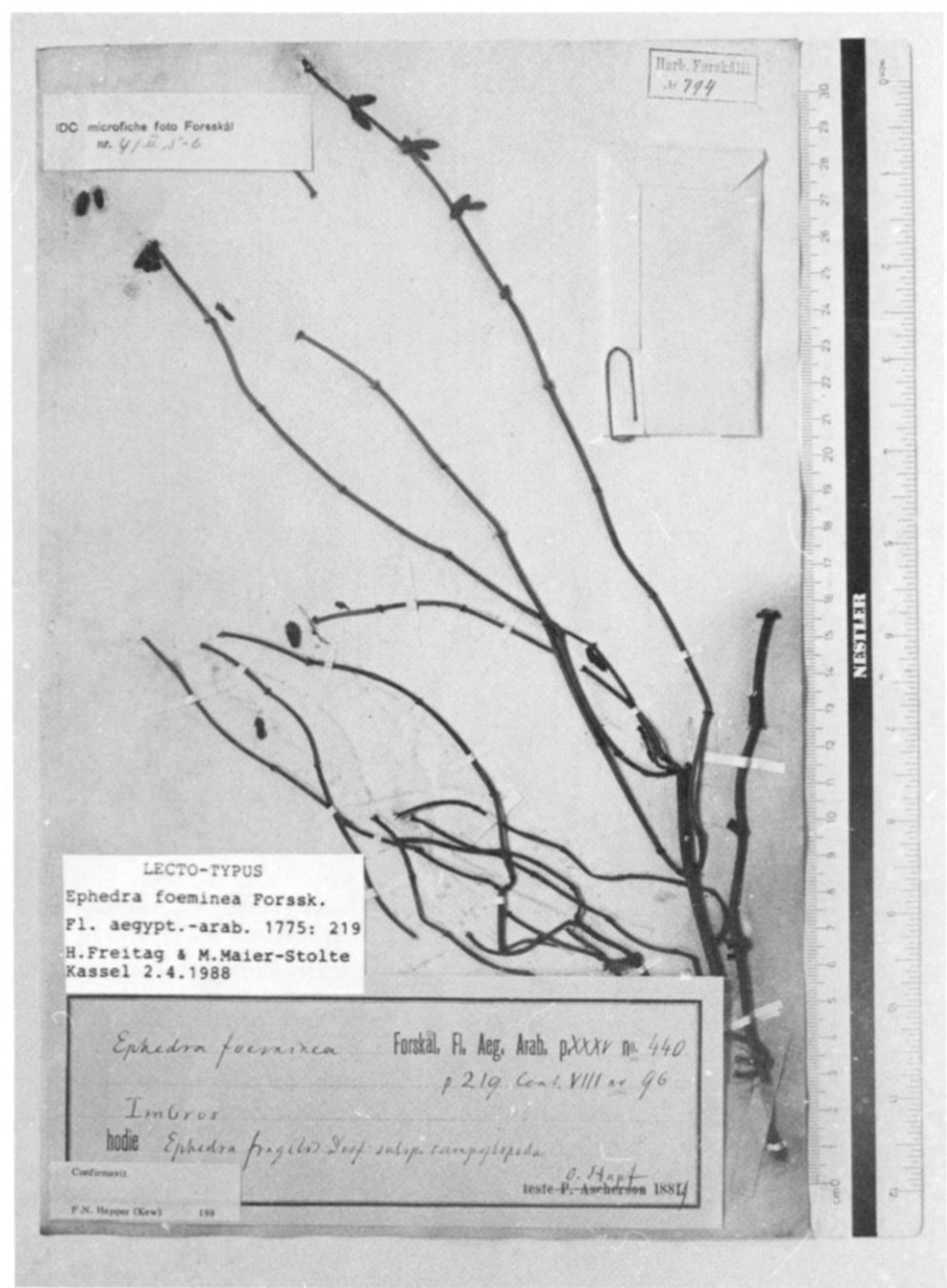
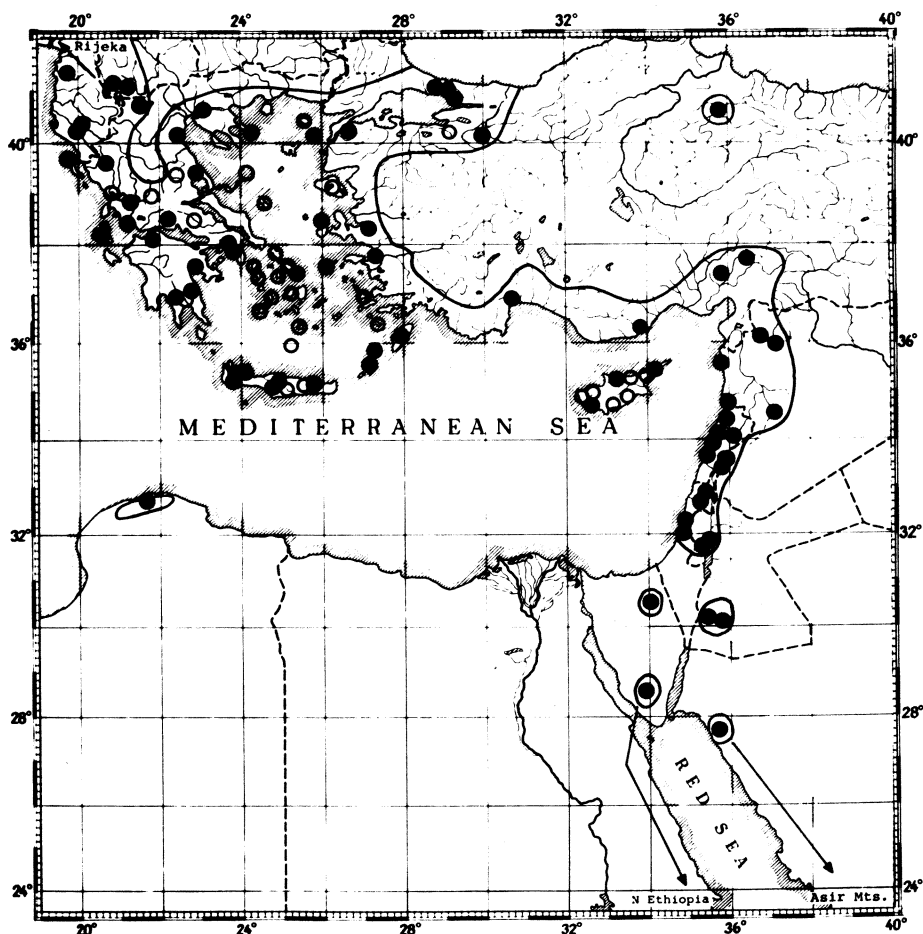


Fig. 5. The lectotype of *Ephedra foeminea* Forssk. in C.

comparatively lately been sorted out and added to the separate Forskål collection. The first isolectotype (IDC microfiche no. 41, III, 1–2) consists of two shorter axes with a few female cones, the second (41, II, 7–8) has four branches, but the cones have disappeared except the peduncles and the lowermost bracts. Probably also the two rather large specimens at BM (one with two female cones) have been collected from the same individual as the



Map 3. Distribution of *Ephedra foeminea* Forssk. The open circles refer to literature records in Halácsy (1904, 1908, 1912), Rechinger (1943), Coode and Cullen (1965), and Meikle (1977).

lectotype. They agree completely in general structure, colour, and developmental stage of their branch systems.

Comments on Distribution and Related Species

The type locality of *E. foeminea* is located in the very center of the distributional area of the E Mediterranean species (Map 3), which extends from N Dalmatia (near Rijeka) along the eastern coast of the Adriatic Sea, all around the Aegean Sea and further to all regions bordering the northeastern part of the Mediterranean Sea. From Lebanon southwards, the continuous area splits up into scattered islands, and the species becomes restricted to montane areas with higher precipitations, as in the mountains of SW Jordan, in Jebel Halal and J. Musa in Sinai, in the Asir Mts. of W Saudi Arabia, and in higher mountains of N Ethiopia. In most southern localities, *E. foeminea* is associated with Mediterranean woodlands or even forests of *Juniperus phoenicea* (see Danin, 1983, for J. Halal; König, 1987, for Asir). Likewise biogeographically significant is the isolated occurrence of *E. foeminea* in those parts of the Cyrenaica, where higher rainfall favours genuine Mediterranean vegetation. The highly disjunct distribution of *E. foeminea* in Africa and

Arabia might be explained either by its endozoochorous diaspores, eventually transported by birds, or by large-scale dislocations of the vegetation belts during the Pleistocene. In our opinion probably both factors were involved. The high humidity requirements of *E. foeminea* are in striking contrast to its closest relatives, the SE Mediterranean *E. aphylla* and the W Mediterranean *E. fragilis*. Both prefer the bushlands and semi-deserts of the hot and dry Mediterranean lowlands.

Ephedra foeminea is closely related to *E. aphylla* and *E. fragilis*, and the three species form a coherent group of geographically more or less vicariant species around the Mediterranean basin. The differences between *E. foeminea* and *E. aphylla* have been discussed already. *Ephedra fragilis* is even more distinct by its higher number of anthers (4–6 versus 3–4), brown colour of pith-parenchyma, pronounced disarticulation of the dry branch systems, 1-seeded female cones, ciliate bracts and leaf sheaths, and the usually compact (only rarely scandent) habit. For a full comparison of the three species and *E. foliata* see Table 1. According to the standards available for classification in the genus *Ephedra* these differences clearly justify specific rank in contrast to the view of many earlier authors.

3. *Ephedra distachya* sensu Forssk., non L.

This third species deserves less attention, because Forsskål used a name of a Linnean species. Even in the absence of both the original material and a description of the specimens, it is certain that the identification by Forsskål was wrong. *Ephedra distachya* does not occur in Egypt at all. The only species occurring in desert habitats near Cairo are *E. aphylla* and *E. alata* Decne. They resemble the W Mediterranean *E. distachya* in its usually more or less (*E. aphylla*) or strictly erect habit (*E. alata*).

Acknowledgments

We wish to thank the directors and curators of the many herbaria who sent us on loan their *Ephedra*-material of the E Mediterranean and adjacent countries: B, BM, C, CGE, E, FI, FT, G, GOET, HUI, JE, K, NY, M, MPU, S, W, WS, and WU. We thank also those who searched without success for possible further Forsskål-specimens in DS, LD, LINN, SBT, and UPS. Special thanks are due to Mr. F. N. Hepper from Kew and to Dr. Jb Friis from C for information concerning the Forsskål-collection and valuable comments on the manuscript. Dr. B. Hansen was very helpful during herbarium work at C. Much appreciated is the generous support given by Professor M. N. El Hadidi, Professor K. H. Batanouny, and other staff members of the Botanical Institute in Cairo during the field work in Egypt and during the revision of the rich *Ephedra*-material preserved in CAI. Professor K. Browicz kindly provided the blank maps. Mrs. E. Laeschke and Mrs. C. Döhler produced the drawings and the maps.

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