TENTATIVE KEYS FOR THE IDENTIFICATION OF SPECIES IN *BIARUM* AND *EMINIUM*, WITH NOTES ON SOME TAXA INCLUDED IN *BIARUM*

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The following keys have been prepared for purely practical purposes during a visit to the herbarium of Kew Gardens in 1978. They are based on the collections I found there, and on relevant literature published since Engler's (1920 monograph. In all those cases where I could not examine correctly identified specimens the keys are no more than a compilation of already existing data and will have to be revised, doubtless, in some details. Nevertheless, I feel they are not quite useless for others as long as a modern treatment is not yet available. I am thankful for any proposals to improve them founded on direct observation of the species in question. My special thanks are due to Mr. Simon Mayo who encouraged the preparation and publication of what is still a primitive tool to handle two of the less popular aroid genera from temperate and subtropical regions in Europe, western Asia and northern Africa.

Biarum Schott

1a. Sterile flowers present between male and female flowers and above the male ones; leaves narrow. . . . . .*B. tenuifolium* (L.) Schott (incl. *B. arundarum* Boiss. & Reut., *B. galiani* Talavera)

1b. Sterile flowers lacking or present only between male and female flowers.....2.

2a. Anthers with a distinctive tip (shortly rostrate). . . . . .*B. spruneri* Boiss.

2b. Anthers without tip or with a very inconspicuous one, not rostrate. . . .3

3a. Sterile flowers distributed fairly equally all overr the axis between male and female flowers . . . . . .*B. eximium* (Schott & Ky.) Engl.

3b. Sterile flowers mainly developed immediately above female flowers or strongly decreasing in size from the female towards the male inflorescence. 4

4a. Margins of tube joined for at least half, usually for three quarters of their length 5

4b. Margins of tube free for more than three quarters of their length 10

5a. Tube of spathe at least slightly inflated, ovoid to oblong-ovoid. 6

5b. Tube of spathe cylindrical, not inflated. 8

6a. Spathe at least 12-15 cm long, often longer. Tube strongly inflated, subglobose, usually wider than lamina; appendix cylindrical . . .*B. straussii* Engl.

6b. Spathe not exceeding 10 cm in length. 7

7a. Tube of the spathe distinctly wider than the narrowly lanceolate lamina . . . . . .*B. olivieri* Blume

7b. Tube of spathe narrower to about as wide as the broadly lanceolate to oblong-lanceolate lamina. . . . . .*B. davisii* Turrill

8a. Margins of the tube joined for about half their length, tube about 15 mm wide. Appendix fusiform . . . . . .*B. fraasianum* (Schott)

8b. Margins of tube joined for at least three quarters of their length; tube usually not more than 1 cm wide. Appendix narrowly cylindrical, sometimes tapering towards apex 9

9a. Sterile flowers short, subulate, all of them directed downwards obliquely to subhorizontally. . . . . .*B. angustatum* (Hook. f.) N. E. Brown

9b. Sterile flowers immediately above female flowers elongate filiform, sometimes widened towerds apex turned upwards, sometimes more or less curled . . . . . .*B. carduchorum* (Schott) Engler

10a. Leaves very narrow, 3-5 mm wide . . . . . .*B. syriacum* (Spreng.) H. Riedl

10b. Leaves lanceolate to oblong, much wider 11

11a. Spathe white inside, greenish outside. Appendix slender, obviously yellow. . . . . .*B. aurantiacum* Moutèrde

11b. Spathe green to dark purple inside. Appendix slender or not, never yellow. 12

12a. Sterile flowers dense, dark purple, confined to the lower part of the axis between female and male flowers. . . . . .*B. aleppicum* Thiébaut

12b. Sterile flowers loose or absent, or if distributed fairly equally all over the axis between female and male flowers distinctly decreasing in length towards the male inflorescence. 13

13a. Appendix very slender, cylindrical, less than 2 mm in diameter . . . . . *B. bovei* Blume (incl. *Ischarum dispar* Schott, *B. carracatrense* Haenseler)

13b. Appendix wider, more or less fusiform, widest at or below the middle of its length. 14

14a. Lamina of spathe wider than tube, rather widely lanceolate, about 20 cm long or longer . . . . . *B. pyrami* (Schott) Engler

14b. Lamina of spathe narrow, usually narrower than tube, distinctly shorter than 20 cm . . . . . .*B. kotschyi* (Schott) B. Mathews ex H. Riedl

According to our present knowledge, some of the species can be subdivided on the basis of cytological and accompanying minor morphological characters. Most of the subunits have been recognized as separate species at one time or another. Investigators in the flora of Europe especially tend to attach too much importance to what is at best a geographical race. As it is often difficult to decide on the appropriate rank, I did not include subspecies or varieties in the key, but it will be necessary to discuss at least some of them, which have been given special attention in more recent publications. They usually belong to the *B. tenuifolium*- or the *B. bovei* complexes, while most of the other species have a more limited distribution in western Asia and have been rarely collected, so that their infraspecific structure is not as yet well known.

B. tenuifolium (L.) Schott s.l.

Engler (1920) acknowledged three distinct varieties: var. *typicum* Engl. (= var. *tenuifolium* according to present day nomenclature), Var. *abbreviatum* (Schott) Engl., and assigned clearly separated areas of distribution to them. The typical variety should be confined to southern Spain, Italy and Dalmatia, var. *abbreviatum* is an endemic of the Greek mainland and the Ionian Islands, and var. *zeleborí*, the easternmost representative of the group, is found in western Anatolia. Though he uses a comparatively great number of combined characters, such as measurements of peduncle, spathe and spadix and relative length of the latter two, leaf shape, etc., I could not find such clear distinctions correlated to geographical distribution in material at Kew. Further investigations including more cytological data will certainly be necessary in future.

Plants from Spain are separated from the type of *B. tenuifolium* by Talavera (1976) as *B. arundanum* Boiss. et Reut. and *B. galiani* Talavera. *B. tenuifolium* has a chromosome number of 2n=26 and *B. arundanum* 2n=22. In *B. galiani*, the chromosome number is also 2n=26, but there are differences in the caryotype as a whole. The morphological characters used by Talavera to separate the species include leaf-shape and number of pointed tips of lower sterile male flowers, but these are scarcely sufficient even for minor local varieties. *B. arundanum* is said to inhabit the extreme south Spain, while *B. galiani* is known from a few localities in southwestern Spain. As far as variable chromosome number is concerned the situation in Spain seems to be comparable to that described by Monti & Garbari (1974) from Italy, who found the differences of *B. cupanianum* Spaglia insufficient for recognition of a separate taxon. However, with further study one or the other of the taxa mentioned may eventually prove to be a distinct subspecies.

B. carduchorum (Schott) Engler

The variability of this species has been discussed by the present author (Riedl 1969) who arrived at the conclusion, that *B. platyspathum* Bornm. = *B. carduchorum* var. *platyspathum* (Bornm) Engl. cannot be separated even on the varietal level. Schott (1869) and Engler (1920) included it in the

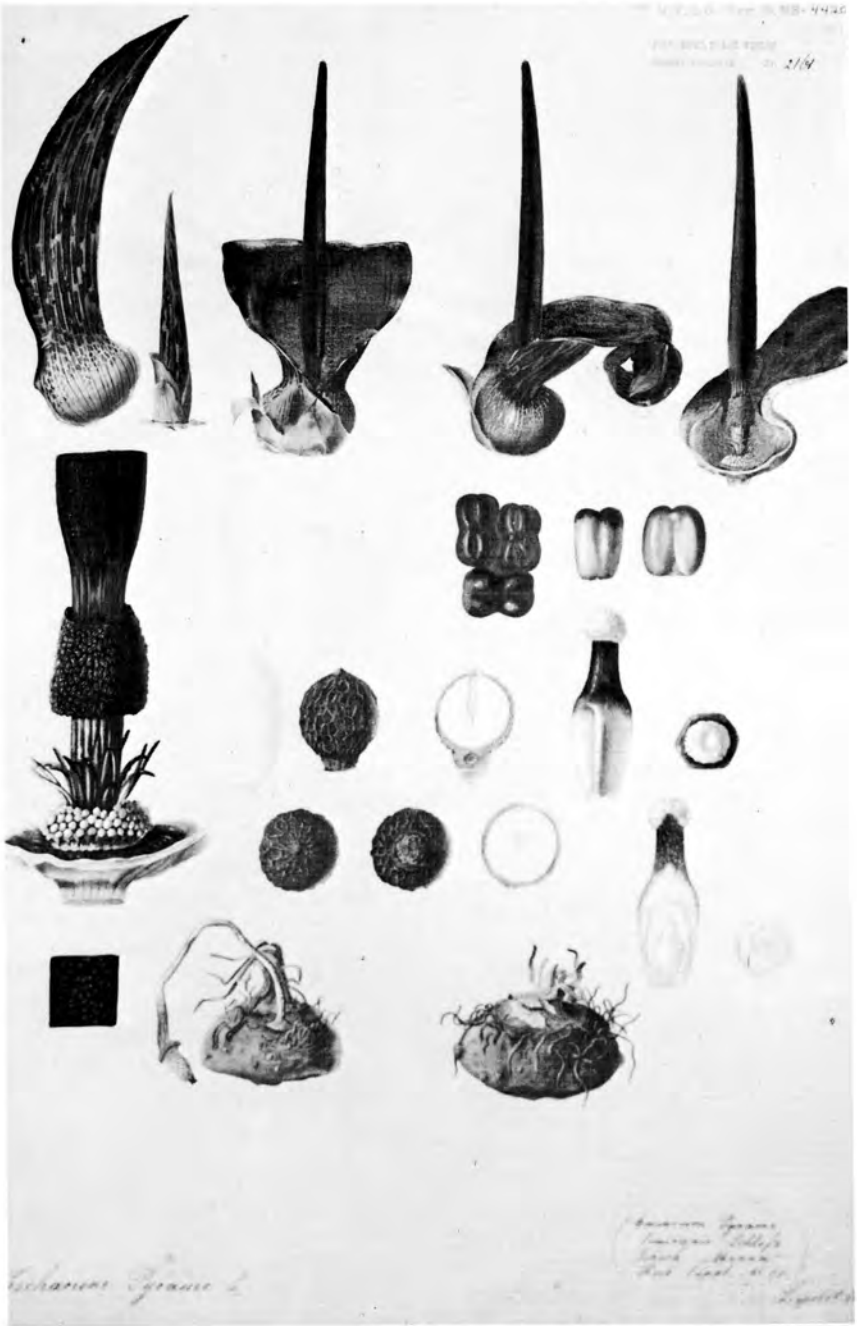

Figure 1: *Biarum pyrami* (Schott) Engler. From H.W. Schott's unedited plates of Aroids. In the absence of a herbarium specimen to be regarded as type.

genus, resp. subgenus *Cyllenium*, for which the rostrate connective of the anthers is typical. I could not find this character in any of the specimens examined, however *B. angustatum* (Hook. f.) N.E. Brown may be only a subspecies of *B. carduchorum* from which it is different mainly in characters of the sterile flowers as indicated in the key.

B. olivieri Blume

The differences between this species and *B. davisii* Turrill seem to be of minor importance, so that the latter will be probably reduced to subspecific rank when more data are available.

B. syriacum (Spreng) H. Riedl

The nomenclature of this species, which is better known as *B. russellianum* Schott has been discussed in a separate paper (Riedl 1980).

B. aleppicum Thiébaut (1948)

I did not see any specimens of this taxon. According to Thiébaut, l.c., it belongs to sect. *Cyllenium* but nothing is said about the anthers in particular. It is compared with B. carduchorum, but according to Moutèrde's (1966) figure 1 on plate LVIII the margins of the spathe are free for the greatest part of the comparatively short tube. It seems to be much nearer to *B. bovei*, as is also assumed by Moutèrde, l.c. I am not sure whether the spots on the outside of the spathe mentioned by both authors are taxonomically significant. Only Moutèrde mentions the densely aggregated sterile flowers in the lower part of the short space between male and female flowers. While Thiébaut describes the sterile appendix as cylindrical, it is markedly widest near the middle in Moutèrde's picture, so that the question arises whether it is near to *B. bovei* or to *B. kotschyi* and *B. pyrami* (if not to *B. carduchorum* as Thiébaut proposed). Unfortunately, the quality of Moutèrde's picture is very bad, so that it can scarcely be used as a reliable source of information.

B. bovei Blume s.l.

B. bovei is by far the most variable species in the whole genus. While *B. bovei* subsp. *dispar* (Schott) Engl. from North Africa seems to be fairly distinct morphologically as well as geographically in most cases, there are a few collections from Turkey, where usually only the typical subspecies should occur, which are morphologically inseparable from subsp. *dispar*. This considerably weakens the argument for a sharp separation. *Biarum carracatrense* Haenseler) Fontquer = *B. haenseleri* Willk. = *B. bovei* subsp. *haenseleri* (Willk.) Engl. is much less distinct from the type and separated mainly for geographical and cytological reasons. For the present, both these taxa should be retained as subspecies as was proposed by Engler (1920), so that nomenclatural changes can be avoided.

B. kotshcyi (Schott) B. Mathew ex H. Riedl, comb. nov.

Syn.: *Ischarum kotschyi* Schott, Synops. Aroid. 7 (1855).

Among the various units merged in *B. bovei* Blume by Engler (1920), *B. kotschyi* seems to deserve a higher rank. Its taxonomic position is intermediate between *B. bovei* and *B. pyrami* (Schott)

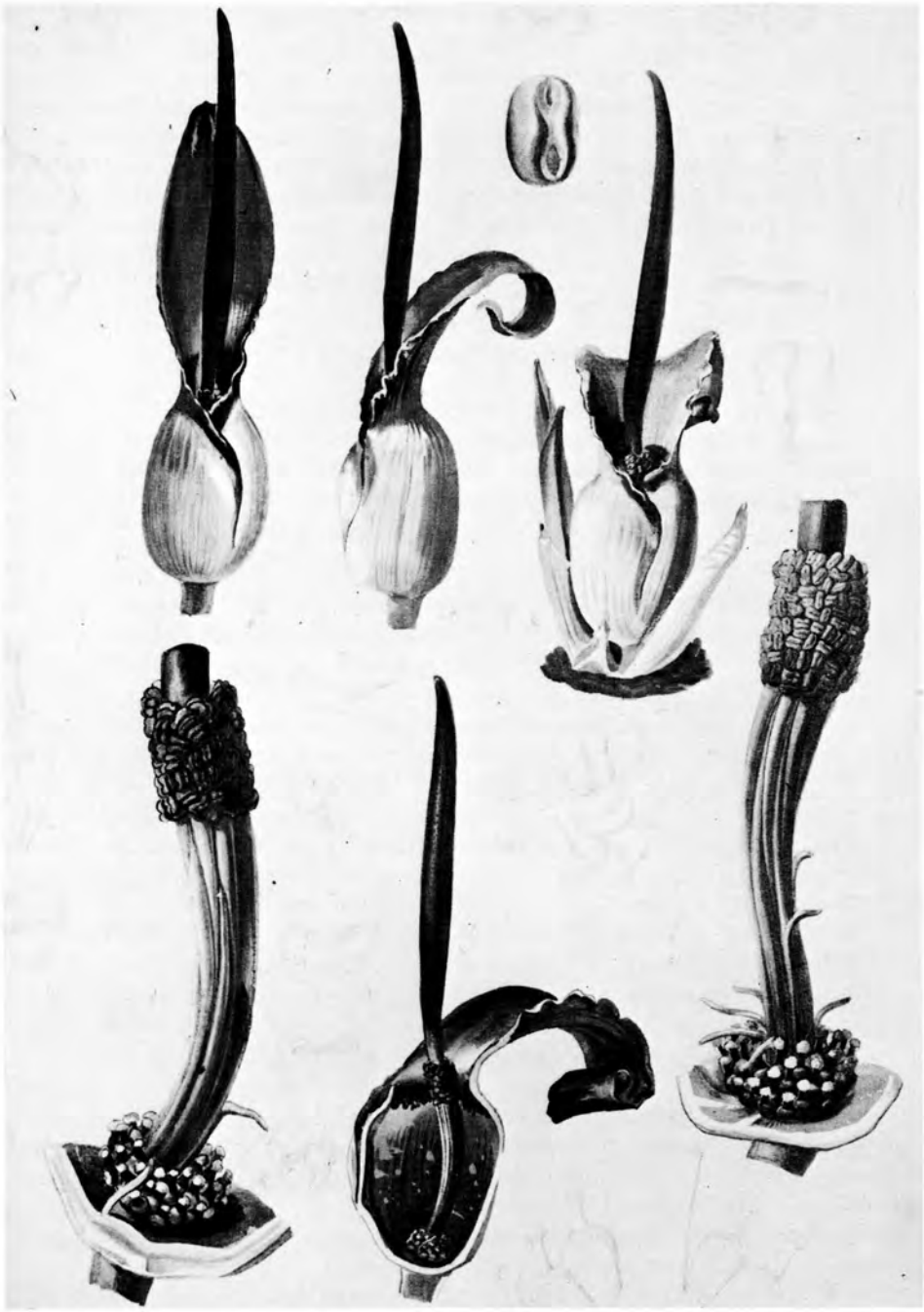

Figure 2: *Biarum kotschyi* (Schott) B. Mathews ex H. Riedl. From H. W. Schott's unedited plates of Aroids.

Engl., to which it is even more similar in many ways (especially characters of the appendix and sterile flowers), but which is much taller. The combination has first been mentioned by B. Mathew (1973), later on by Mayo (1979), but seems to be validated here for the first time.

The *Biarum* spec. from Afghanistan, for which chromosome counts are given by Marchant (1972) is almost certainly *(Eminium lehmannii* (Bge) O. Ktze. which often closely resenbles a true *Biarum* having lanceolate-oblong, undivided leaves. The genus *Biarum* does not extend east beyond western and southwestern Iran.

Eminium (Blume) Schott

1a. Inner side of spathe dark, densely warty. Lateral leaf segments involute ("winding staircase"-type, see Riedl 1978). Sterile appendix of spadix broadly cylindrical . . . . . *E. spiculatum* (Blume) O. Ktze.

1b. Inner side of spathe usually more or less dark, but smooth 2

2a. Peduncle thickened markedly towards spathe 3

2b. Peduncle not or scarcely thickened towards spathe 6

3a. Leaves with divided lateral and/or opposite segments 4

3b. Leaves entire or with undivided subbasal lobes which are much shorter than the central lamina. Sterile appendix of spadix slender, cylindrical 5

4a. Central part of lamina lanceolate to hastate, much broader than lateral and opposite segments. Opposite segments involute, narrowly linear, strongly divided. Spathe straight. Appendix of spathe cylindrical, slender . . . . . *E. albertii* (Regel) Engler

4b. Central part of lamina broadly oblong, rounded. Lateral segments more or less flat, widely linear, with a few divisions, as long or longer than the central part. Spathe curved downwards above the spadix as a rule, more or less short and wide. Appendix of spadix broadly cylindrical to conical, very short . . . . . *E. rauwolffii* (Blume) Schott

\+ Sterile appendix of spadix shortly stalked, more or less cylindrical to slightly conical . . . . . *E. r.* var.*rauwolffii*

\- Sterile appendix of spadix sessile on male flowers, conical . . . . . .*E. r.* var. *kotschyi* (Schott) H. Riedl

5a. Sterile appendix of spadix nearly sessile, tapering gradually towards male inflorescence. Tuber depressed, much wider than tall . . .*E. regelii* Vved.

5b. Sterile appendix of spadix distinctly stipitate, either abruptly or gradually tapering towards the pale, short stipe (appendix dark purple, stipe straw-colored in herbarium specimens). Tuber globose . . . . *E. heterophyllum* (Blume) Schott

6a. Leaves with involute opposite segments, strongly divided ("winding staircase"); Sterile appendix of spadix slender to broadly cylindrical . . . . . *E. intortum* (Banks & Soland) O. Ktze.

6b. Leaves without any lateral or opposite segments, lanceolate. Sterile appendix of spadix slender, cylindrical . . . *E. lehmannii* (Bge) O. Ktze.

The taxonomy of the genus *Eminium* has been discussed more in detail in earlier papers (Riedl 1969, 1980), so that it is not necessary to add further comments in this place.

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Literature Cited

Engler, A. 1920. Araceae-Aroideae and Araceae-Pistioideae, in: Das Pflanzenreich IV. 23F. Leipzig: Wilhelm Engelman.

Marchant, C. J. 1972. Chromosome variation in Araceae: IV. Areae.Kew Bull. 26: 395-405

Mathew, B. 1973. Dwarf Bulbs. London: Batsford (p. 47).

Mayo, S. 1979. Aroids at Kew. Aroideana 2(1), 3-14.

Monti, G. & F. Garbari 1974. Appunti citotassonomici sul genere Biarum Schott (Araceae) in *Italia. Giorn. Bot. Ital.* 108: 19-26.

Moutèrde, P., S. J. 1966. Nouvelle Flore du Liban et de la Syrie. Tome prêmier, Texte et Atlas. Beyrouth: Editions de l'imprimerie catholique.

Riedl, H. 1969. Kritische Untersuchungen über die Gattung *Eminium* (Blume) Schott nebst Bemerkungen zu einigen anderen Aroideen der südwestasiatischen Flora. *Ann. Naturhistor. Mus. Wien* 73: 103-121

Riedl, H. 1978. Heinrich Wilhelm Schott as a developmental morphologist. *Aroideana* 1(3): 77-85.

Riedl, H. 1980. On two Aroids described in Russell's "Natural History of Aleppo" (1794). *Aroideana 3*, in press.

Schott, H. W. 1860. Prodromus systematis Aroidearum. Vindobonae.

Talavera, S. 1976. Revision de las especies espanolas del genero Birarum Schott. *Lagascalia* 6(2): 275-296.

Thiébaut, J. 1948. Quatrième note sur quelques plantes de la flore Libano-syrienne; *Bull. Soc. Bot. France* 95: 17-21.

AROID LITERATURE

W. Crusio, 1979. A Revision of *Anubias* Schott (Araceae), Mededelingen Lanbouwhogeschool Wageningen, Nederlands 79-14. 48pp.

The genus *Anubias* contains 8 species of terrestrial aroids which grow in dark rain forests and along waterways in tropical western Africa. This revision of the genus by W. Crusio reports a thorough study based on cultivated plants and herbarium specimens. It is a detailed and comprehensive work which will stand as the basic reference on this previously poorly-known genus. The monograph is well illustrated with drawings, photographs, and maps.

Although only *Anubias barteri* is known to me in cultivation, the drawings of several other species, especially *A. gigantea*, suggest that these would be excellent plants for indoor horticulture. The tough leaves are extremely shade-tolerant, and the plants thrive even if left in standing water. Any aroid enthusiast contemplating travel in western Africa will want to peruse this monograph beforehand. -- MTM