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The Synopsis of the Genus *Biarum* Schott (Araceae) in Türkiye, With Complementary Notes and a Key to the Species

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ABSTRACT
The aim of this study is to conduct systematic research on *Biarum*, which is one of the taxonomically problematic genera in Türkiye. It was determined that the number of *Biarum* taxa in Türkiye is 12. It is decided that *Biarum* x *cinarense, B. ditschianum, B. davisii* subsp. *marmarisense*, *B. rifatii,* and *B. eximium* are the endemic taxa to Türkiye, and the endemism rate is 41.6%. In this study, taxonomic notes, diagnostic keys, general distribution as well as their conservation status of each species are given. Some of the new collections and herbaria records of Türkiye and abroad are included. The checklist of the genus is given with all the changes, synonyms, and related revisions. Taxonomical changes that have occurred since the publication of Flora of Turkey are included. New findings and a key to the 12 species of *Biarum* genus in Türkiye are provided.

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Türkiye'deki *Biarum* Schott (Araceae) Cinsinin Sinopsisi, Tamamlayıcı Notlar ve Tür Teşhis Anahtarı

ÖZET
Bu çalışmanın amacı, Türkiye'de taksonomik olarak sorunlu cinslerden biri olan *Biarum* cinsi üzerinde sistematik bir araştırma yapmaktır. Türkiye'deki *Biarum* takson sayısının 12 olduğu belirlenmiştir. *Biarum x cinarense*, *B. ditschianum*, *B. davisii* subsp. *marmarisense*, *B. rifatii* ve *B. eximium*'un Türkiye'ye endemik taksonlar olduğu ve endemizm oranının %41,6 olduğu belirlenmiştir. Bu çalışmada, her türün taksonomik notları, teşhis anahtarları, genel dağılımları ve koruma durumları verilmiştir. Türkiye ve yurtdışından bazı yeni koleksiyonlar ve herbaryum kayıtları eklenmiştir. Cinsin kontrol listesi, tüm değişiklikler, sinonimler ve ilgili revizyonlar birlikte verilmiştir. Türkiye Florası'nın yayınlanmasından bu yana meydana gelen taksonomik değişiklikler eklenmiştir. Türkiye'deki *Biarum* cinsine ait 12 türü kapsayan yeni bulgular ve bir teşhis anahtarı anahtarı verilmiştir.

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INTRODUCTION
In Türkiye, the Araceae family has 10 genera, and the number of taxa has increased to 44 (Yıldırım, 2018). Nine taxa belonging to the family are endemic to Türkiye (Yıldırım & Erdem, 2019).
The genus *Biarum* consists of 22 species of tuberous plants found in semiarid regions of Southern Europe, North Africa, the Near and Middle East (POWO, 2025). The center of diversity is the Middle East, where 75% of the species are endemic (Boyce, 2008).
In the treatment of genus *Biarum* in the Flora of Turkey, Mill (1984) accepted 6 taxa. Later, Boyce (1987) described a new endemic taxon from Türkiye, known as *Biarum davisii* Turrill subp. *marmarisensis* P.Boyce. Moreover, Bogner and Boyce (1989) described a new endemic species from Türkiye, namely *B. ditschianum* Bogner & P.C.Boyce. Since then, Boyce has studied the revision of genus *Biarum* worldwide (Boyce, 2006). According to this

revision (Boyce, 2006), *Biarum davisii* subp. *marmarisensis* is reevaluated as a distinct species with the name of *Biarum marmarisense* (P.C. Boyce) P.C. Boyce. *Biarum pyrami* (Schott)Engler is reevaluated as *B. pyrami* (Schott) Engler var. *pyrami*. On the other hand, it is reported that *Biarum crispulum* (Schott) Engl. and *B. kotschyi* (Schott) B.Mathew ex H.Riedl have a natural distribution in Türkiye (Boyce, 2006). Akan & Balos (2008) published a new record for Türkiye, namely *Biarum syriacum* (Spreng.) H.Riedl. Later, Yıldırım et al. (2016) published a new record for Türkiye, namely *Biarum aleppicum* J. Thiébaut. In addition, *Biarum rifatii* Yıldırım & Altıoğlu was published as new species for Türkiye (2016). *Biarum marmarisense* reevaluated as *Biarum davisii* subp. *marmarisensis* (Yıldırım, 2018). Çeçen et al. (2022), published *Biarum× cinarense* as a new natural hybrid from Türkiye. Thus, the total number of *Biarum* taxa recorded in Türkiye has now increased to 12. Endemism rate is 41.6% in Türkiye (Çeçen et al., 2022).

In Türkiye, the genus members known as; sucukotu, yılanpancarı, ağukınası, kârdi, kâri, zilikê ereba, asalan, kurt kulağı, fıse pire (Alpınar, 1985, 1987; Balos & Akan, 2007; Akan et al., 2008, 2013; Altay & Çelik, 2011; Altay et al., 2015; Kocabaş & Gedik, 2016).

The problems of genus were stated in the Flora of Turkey, and it is stated that the taxa in *Biarum* have different flower and leaf periods, making it difficult to diagnose the species. Therefore, it is emphasized that work on these genera is necessary (Davis & Hedge, 1975; Mill, 1984; Davis et al., 1988).

Studies conducted on the *Biarum* genus in recent years are chronologically as follows: Boyce (2006), Akan et al. (2008), Akan & Balos (2008), Boyce (2008), Yıldırım et al. (2016), Yıldırım & Altıoğlu (2016), Akyol et al. (2018), Yıldırım (2018), Çeçen et al. (2019), Altuntaş (2020), Balos et al. (2021), Tel & Akan (2021), Çeçen et al. (2022), Bağatur et al. (2023). The aim of this study is to conduct systematic research on *Biarum*, which is one of the taxonomically problematic genera in Türkiye.

MATERIAL and METHOD

The research material consists of taxa of the *Biarum* genus collected from different localities of Türkiye between 2020 and 2022. The specimens have been identified by the Flora of Turkey (Mill, 1984; Davis et al., 1988; Alpınar, 2000; Yıldırım, 2018).

In addition, the specimens kept in the herbaria of AEF, ANK, DUOF, EGE, GAZI, HUB, HARRAN, ISTE, and NGBB were examined. Type specimens kept in abroad herbaria, such as E, K, B, G, BM, P, and W herbaria, were also examined (Thiers, 2019). Herbarium specimens in Türkiye and from abroad were examined, but only some of them could be given here. The specimens determined as lectotypes in the study of Boyce (2008), which was the most fundamental revision made before this study, were taken as a basis.

Red list categories of endemic taxa were revised according to IUCN Red List Categories (Ekim et al., 2000; Yıldırım, 2018; IUCN, 2022). These categories are stated with their abbreviations: CR: critically dangered, EN: endangered, VU: vulnerable, NT: near threatened, LC: least concern.

Turkish names of plants belonging to the taxa were given according to Güner et al. (2012), Yıldırım (2018), Çeçen et al. (2022).

The location, altitude, date, habitat, collector number, and endemism status of the plant were given.

The grid system proposed by Davis (1965) was used for the distribution of each species.

Specimens collected during this study were kept in the HARRAN herbarium, Arts and Science Faculty of Harran University, Department of Biology, Şanlıurfa.

Important taxonomic characters of the genus *Biarum* were determined (Figure 1). These were determined as shape of tuber, plant height, leaf shape, leaf limb length, leaf width, petiole length and surface features, spathe shape, spathe color, spathe dimensions, spathe length, spathe condition, spadix length, spadix appendix shape, spadix appendix length and color, male flower region length, sterile flower region length and female flower region length (Boyce, 2008).

RESULTS

Biarum Schott in Schott & Endlicher, Melet. Bot. 17 (1832) nom. cons.

Type: *Biarum tenuifolium* (L.) Schott.

In the treatment of Boyce (2008) and the International Plant Names Index and World Checklist of Vascular Plants (2024), 6 synonyms are given for *Biarum*:

Homaid Adans., Fam. Pl. (Adanson) 2: 470 (1763).

Homaida Raf., Fl. Tellur. 3: 63 (1837).

Ischarum (Blume)Rchb., Deut. Bot. Herb. -Buch 32 (1841).

Cyllenium Schott., Gen. Aroid. t. 9 (1858).

Leptopetion Schott., Gen. Aroid. t. 8 (1858).

Stenurus Salisb., Gen. Pl. [Salisbury] 5 (1866).

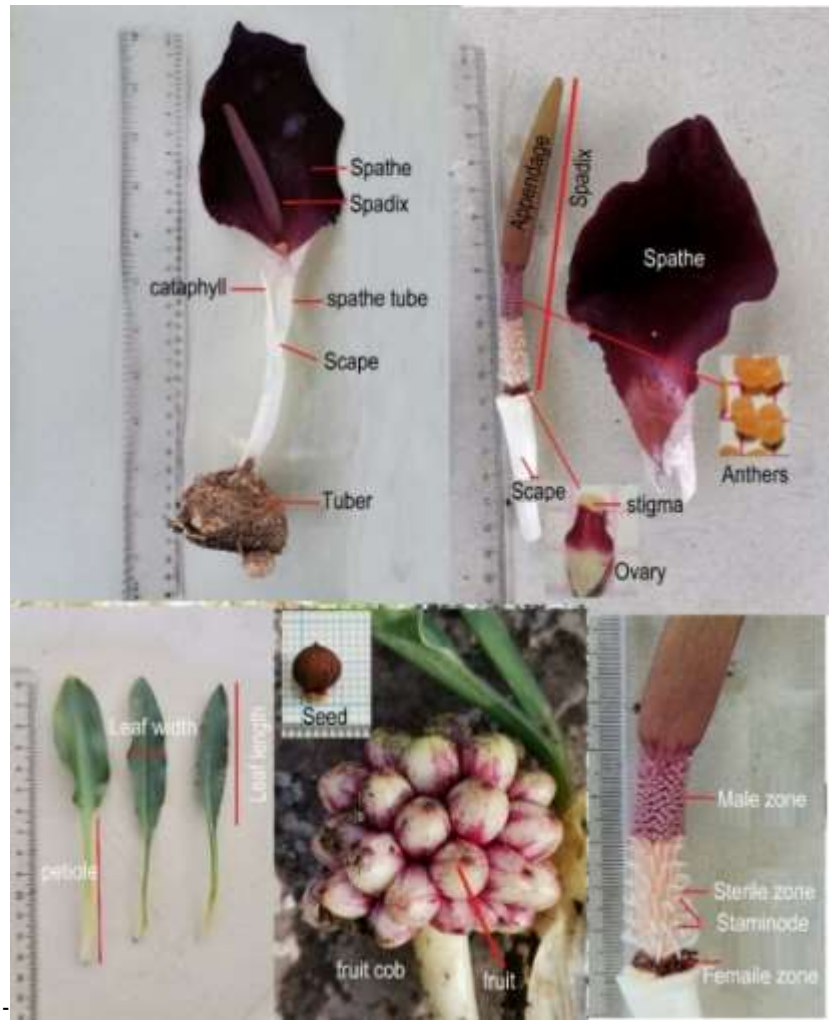

Figure 1. General morphological characteristics of the genus *Biarum*
Şekil 1. Biarum cinsinin genel morfolojik özellikleri

Identification key of the Turkish *Biarum* species:

1. The flowering period is the spring or summer months
   2. Staminodes are present in both the upper and lower regions of the male flower region……***B. tenuifolium*** **subsp. *zelebori***
   2. Staminodes are located in the region between male and female flowers, or staminodes are absent
      3. Appendix is quite thick, yellow, with a downward-pointing hair-covered area at its base; spathe palm is quite blunt and much shorter than spathe tube…..***B. ditschianum***
      3. Appendix not as above, glabrous at base; has spathe, longer or shorter than the tube
         4. Sterile flowers present; leaves 11–27, leaf limb linear to linear-elliptic; spathe tube inner surface upper half light purple, lower half white ……***B. syriacum***
         4. Sterile flowers absent (rarely 1–2); leaves 3–7; lamina elliptic to oblanceolate-elliptic, inner surface of spathe tube dark shiny reddish-purple ……***B. rifatii***
1. The flowering period is the autumn or winter months
   5. Spathe tube swollen, globose to oblong
      6. No sterile flower……***B. davisii*** subsp. ***marmariense***
      6. Sterile flower present
         7. Spathe limb narrow (0.7-1.2 cm).....***B. crispulum***
         7. Spathe limb wide (1.9-8 cm)
            8.Spathe tube swollen rectangular-cylindrical; spathe limb linear-lanceolate; 7–12 cm x 1.9–6 cm; spadix appendix narrowly fusiform to fusiform-cylindrical, 6.5–13 cm x 2–9 mm.....***B. bovei***
            8. Spathe tube globose to globose-rectangular; spathe limb considerably expanded at the base, lanceolate, 9–24 × 2.2–8 cm; spadix appendix cylindrical-nebulate, 10–28 cm × 3–10 mm.....***B. pyrami***
   5. The tube of the spathe is not swollen or slightly swollen, the scapula tube is not swollen or slightly swollen
      9. Scapulae present throughout the sterile floral region……***B. eximium***
      9. Scapulae extend halfway into the sterile region or slightly
         10. Outer cataphylls not fibrous, ivory colored……***B. carduchorum***
         10. Outer cataphylls fibrous, brown

11. Leaves 7–28; leaf limb width 0.6–1.9 cm ……..…….***B. aleppicum***
11. Leaves 4–11; leaf limb width 1.2–3 cm ……..***B. x cinarense***

1. ***Biarum aleppicum*** J.Thiébaut, Bull. Soc. Bot. France 95:21 (1948). (Figures 2-3, 26) /**Urfa yılanpancarı**
Lectotype: Syria, Alep, *Fr. Louis s.n.* (lectotype P00733219!, isolectotype K, photo!), lectotype designated by Boyce (2006).
Synonym:
Biarum bovei var. *aleppicum* (J.Thiébaut) Gombault [*in sched. nom. nud.*].

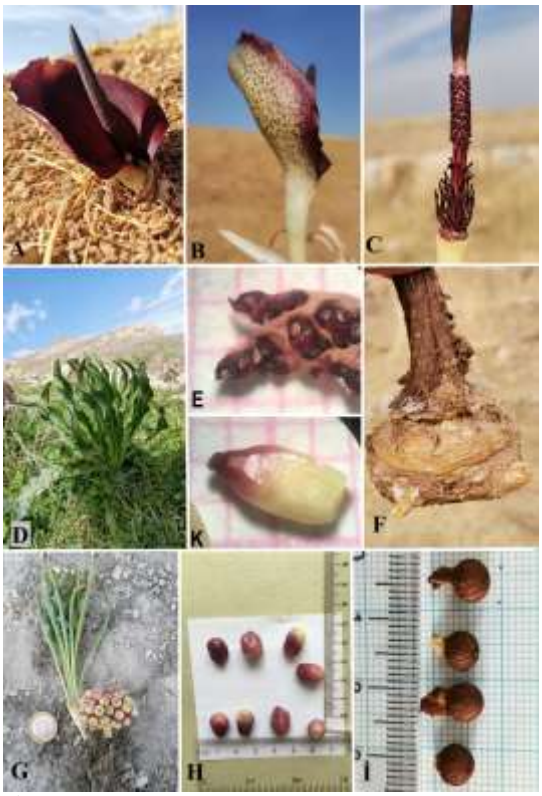

Figure 2. *Biarum aleppicum* A- flower front part, B- flower back part, C- flower reproductive organs, D- leaves, E- common flower, K- female flower, F- tuber, G- fruit cob and leaves, *H-fruit, I- seeds*
Şekil 2. Biarum aleppicum A- çiçeğin ön kısmı, B- çiçeğin arka kısmı, C- çiçek üreme organları, D- yapraklar, E- ortak çiçek, K- dişi çiçek, F- yumru, G- meyve koçanı ve yapraklar, H-meyve, I- tohumlar

Figure 3. Lectotype specimen of *Biarum aleppicum* (P00733219)
Şekil 3. Biarum aleppicum'un lektotip örneği (P00733219)
http://coldb.mnhn.fr/catalognumber/mnhn/p/p00733219

Examined specimens: C7 Şanlıurfa: Birecik, Zeytinbahçe village, limestone slopes, 350 m, 08.10.2020, *C. Çeçen 1114* (HARRAN!); Birecik-Mezra village, 1 km S of Akarçay, steppe, 480 m, 23.04.2015, *H. Yıldırım 3186* (EGE!); **Diyarbakır**: Mardin-Çınar 55 km, roadside, 660 m., 13.10.2020, *C. Çeçen 1123* (HARRAN!); **C8 Mardin**, Nusaybin to Midyat, Yemişli village, steppe, 950 m, 24.10.2020, *Balos 4900* (HARRAN!); Mazıdağı, Bağyaka village, slopes of dried stream, 825 m, 27.03.2021, *Balos 5049* & *Geçit* (HARRAN!); Artuklu, Sultançayırı district, 1140 m, 28.03.2021, *Balos 5079* (HARRAN!).
Note: *Biarum aleppicum* is close to *B. carduchorum*, which is distributed in the Eastern and Southeastern Anatolia regions of Türkiye, and *B. angustatum* (Hook.f.) N.E.Br., which is distributed from SW Syria to Israel. *B. aleppicum* was known to be distributed only in Northwestern Syria until 2016. However, it was published as a new record from Türkiye by Yıldırım et al. (2016). *B. aleppicum* is also similar to *B. eximium*. However, it is distinguished from this species by the spathe tube being separated to the base, the stigmas not having any style, the staminodes being dense at the base, and the leaf limb being thinner. In *B. aleppicum*, it is easily distinguished from other species by the fact that the stigma is sessile. In addition, the fruit cob of *B. carduchorum* is white, while in *B. aleppicum* it is purplish.
2. *Biarum bovei* Blume**,** Rumphia 1: 114 (1836) (Figures 4-5, 26) /**Yılanpancarı**
Holotype: Lebanon, mountains of Lebanon, 1832, *Bové N. 379* (Holotype L0041870!, isotype L0041869!, L0041871!, P00733220!, P00733221!, K00400398!).
Synonyms:
Biarum bovei var. *blumei* Engl., Monogr. Phan. [A.DC. & C.DC.] 2: 577 (1879).
Biarum homaid Blume, Rumphia 1: 115 (1836)

Figure 4. A- *Biarum bovei* in field, B- flower back, C. leaves, D- flower reproductive organs, E- tuber, F- fruit cob, H- male flower part, J- female flower part, K- N- female flower, L- male flower, M- seed, O- spadix and scape
Şekil 4. A- Doğada Biarum bovei, B- çiçek sırtı, C. yapraklar, D- çiçek üreme organları, E- yumru, F- meyve koçanı, H- erkek çiçek kısmı, J- dişi çiçek kısmı, K- N- dişi çiçek, L- erkek çiçek, M- tohum, O- spadiks ve sap

Figure 5. *Biarum bovei* holotype (L0041870)
Şekil 5. Biarum bovei holotip (L0041870)
https://data.biodiversitydata.nl/naturalis/specimen/L%20%200041870

Caladium bovei Steud., Nomencl. Bot., ed. 2, 1: 249 (1840)
Biarum kotschyi (Schott) B.Mathew ex Riedl, Aroideana 3(1): 28 (1980).
Homaida bovei Kuntze, Revis. Gen. Pl. 2: 742 (1891).
Ischarum bovei Schott, Syn. Aroid. 7 (1856).
Examined specimens: B7 Tunceli: Ovacık, above Paşadüzü village, Korti stream, 28.10.1980, *Ş. Yıldırımlı 4107* (HUB 34097!); **Malatya:** Erkenek, Ağözü district, 13.10.1989, *E. Aktoklu 1653* (ISTE 94601!); **B8 Elazığ:** Karakoçan-Sarıcan, Horşi district, steppe, 1550 m., 02.10.2021, *C. Çeçen & V. Sonay 1185* (HARRAN!); **B9 Van:** Gevaş, Göründü to Altınsaç village, 09.10.2003, *M. Koyuncu 14070* (AEF 25691!); **C6 Kahramanmaraş:** Elbistan, 22.10.1986, *S. Bayrı* (ISTE 57651!); Göksun, Höbek mountain, above Döngel cave, 23.10.1980, *B. Yıldız 2344* (HUB!); **C7 Şanlıurfa**, Eyyübiye to Akçakale, hills, 550 m., 15.11.2020 *C. Çeçen &. M. Balos 1145* (HARRAN!)*;* Halfeti, Savaşan village, steppe, 560 m., 05.03.2022 (at leaf) *C. Çeçen 1192* &. *M. Balos* (HARRAN!); **C8 Mardin:** W of Midyat, Acırlı village, 920 m, 20.11.2020 *C. Çeçen M. Balos & H.Akan 1151* (HARRAN!).
Note: *B. bovei* is a species with a fairly wide distribution. In field studies, it was observed that spathe length, spadix appendix size and thickness, and width of the leaf limb of *B. bovei* varied. It is similar to *B. crispulum*, *B. dispar*, *B. kotschyi,* and *B. pyrami* in that the spathe tube is swollen and the flower and leaf are seen at the same time. *B. kotschyi* was discussed within the variation limits of *Biarum bovei* by Yıldırım (2008). Boyce (2008) stated that *Biarum bovei* is confused with *B. kotschyi* and *B. pyramid,* both in the natural area and in herbarium specimens. He stated that the main reason for this is the scarcity of real *B. bovei* in herbaria and the fact that most of the type specimens are pressed in a way that makes comparison difficult. Examination was carried out on fresh specimens collected from Mardin and Şanlıurfa, and the description of the species was expanded. The observations showed that the spathe size of *B. bovei* varies. In Midyat, town of Mardin, and Karaköprü, town of Şanlıurfa specimens, it was seen that the spathe was thin and long, the outer surface of the spathe was green, and the leaves were thin. It was seen that the specimens near Yemişli village between Mardin-Nusaybin and the specimens in Eyyübiye district of Şanlıurfa had larger spathes and narrower leaf limbs. In some specimens, it was seen that the outer surface of the leaf limb was spotted, and the leaf limb was wider. Since *B. bovei* and *B. carduchorum* share the same habitats, it is predicted that the specimens with spotted spathe may be hybrids of *B. bovei* and *B. carduchorum*. A large-scale study at the phylogenetic population level is needed to clarify this situation.
3. *Biarum carduchorum* (Schott) Engl., Monogr. Phan. 2: 575 (1879) (Figures 6-7, 26) / **Kardi**
Lectotype: Türkiye, Schirwan (Şirvan), Kotschy *s.n.* (holotype W destroyed; lectotype W, designed by Boyce (2006), Schott's leones no. 1825).

Figure 6. *Biarum carduchorum* A- habitus, B- flower front view, C- flower reproductive organs, D- leaves, E- cob, F- herbarium specimen H- tuber, J- fruit, K- seeds, L- female flower, M- male flower
Şekil 6. Biarum carduchorum A- habitus, B- çiçeğin ön görünümü, C- çiçek üreme organları, D- yapraklar, E- koçan, F- herbaryum örneği H- yumru, J- meyve, K- tohumlar, L- dişi çiçek, M- erkek çiçek

Figure 7. *Biarum carduchorum* Epitype (K000400388)
Şekil 7. Biarum carduchorum Epitip (K000400388)
http://specimens.kew.org/herbarium/K000400388 (© RBG Kew)

Epitype**:** Türkiye, B7 Tunceli, Sakaltutan mountain, E side; 10 km NE of Pertek; hills, soft limestone, fallow fields and *Quercus* schrub. Common, local, alt. 1550 m, Flowers mahogany brown, 23 September 1966, A, C & Watson 2404 (Epitype K000400388!,) (Epitype designed here).
Synonyms:
Biarum platyspathum Bornm., Repert. Spec. Nov. Regni Veg. 5: 57 (1908).
Biarum carduchorum var. *platyspathum* (Bornm.) Engl., Pflanzenr. (Engler) IV, 23F: 137 (1920).
Biarum platyspathum var. *bakhtyarum* Parsa, Kew Bull. 4: 36 (1949).
Homaida carduchorum Kuntze, Revis. Gen. Pl. 2: 742 (1891).
Cyllenium carduchorum Schott, Prodr. Syst. Aroid. 65 (1860).
Examined spcimens: B8 Elazığ: Karakoçan, Sarıcan district, steppe, 1200 m, 02.10.2021, *C. Çeçen 1186* (HARRAN!); **C7 Adıyaman:** Kahta, Çiçek village, dry riverbank, 650 m, *C. Çeçen 1181* (HARRAN!); **Diyarbakır:** Çınar to Mardin 5 km, nearby dam lake, 660 m, 13.10.2020, *C. Çeçen &. M. Balos1125* (HARRAN!); **Şanlıurfa:** Şanlıurfa-Viranşehir, district Çoban stream, steppe, 690 m, 13.10.2020, *C. Çeçen &. M. Balos 1118* (HARRAN!); **C8 Mardin:** Mardin to Diyarbakır 15 km, stony slopes, 1040 m, 13.10.2020, *C. Çeçen 1121 &. M. Balos* (HARRAN!).
Note: *B. carduchor*um is distributed from the Eastern and Southeastern Anatolian Regions of Türkiye to Southern Iran. It is similar to *B. aleppicum*, *B. angustatum* and *B. eximium* in terms of the mottled outer surface of the spathe. It can be easily distinguished from *B. aleppicum* and *B. eximium* by the union of the spathe tube in the upper quarter and the condition of the sterile flowers. It is easily distinguished from *B. angustatum* by the upward position of the sterile flowers and the wider leaves. It was revealed for the first time that the tuber was offspringless for *B. carduchorum*.
4. *Biarum × cinarense* Çeçen, H. Akan, Yıldırım & Balos, Ann. Bot. Fenn. 59(1): 67 (2022) (Figures 8-9, 26) / Çınar yılanpancarı
Holotype: Türkiye. Diyarbakır Province, Çınar district, Mardin-Diyarbakır road 5 km from Çınar, around Göksu dam, Akçomak village road, stony steppe areas, 660 m, 13 October 2020 *C. Çeçen 1135 & Balos* (Holotype HARRAN!; isotype HARRAN!, EGE!).
Examined specimens: Diyarbakır: Çınar-Diyarbakır 25 km, steppe, 660 m, 13.10.2020, *C. Çeçen 1135* & *Balos* (HARRAN!; EGE!); ibid., 28.03.2021 (at leaf), *C. Çeçen 1161* (HARRAN!).

Figure 8. *Bairum* x *cinarense* A- habitus, B- flower front view, C- flower reproductive organs, D- leaves, E- cob, F- herbarium specimen H- tuber, J- fruit, K- seeds, L- female flower, M- male flower
Şekil 8. Bairum x cinarense A-habitus, B- çiçeğin ön görünümü, C- çiçeğin üreme organları, D- yapraklar, E- koçan, F- herbaryum örneği H- yumru, J- meyve, K- tohum, L- dişi çiçek, M- erkek çiçek

Figure 9. *Biarum x cinarense* holotype (C. Çeçen & M. Balos 1135, HARRAN!)
*Şekil 9. Biarum x cinarense holotipi (*C. Çeçen & M. Balos 1135, *HARRAN!)*

Note: *Biarum x cinarense* was identified and published as a new natural hybrid species recently (Çeçen et al., 2022). It is morphologically a hybrid species between *B. aleppicum* and *B. carduchorum*. It resembles to *B. aleppicum* in terms of its tuber structure, hard outer cataphylls, spathe color, and frilled leaves. It is easily distinguished from *B. aleppicum* by the long lanceolate spathe, wider leaf limb, lighter color, and fewer leaves. It is easily distinguished from its parent, *B. carduchorum,* by having hard cataphylls and different male, female, and sterile regions. The species epithet is derived from the Çınar district of Diyarbakır province in Türkiye, where the species was first gathered. It is a local endemic to Diyarbakır, SE Türkiye.

5. *Biarum crispulum* (Schott) Engl., Bot. Jahrb. 5: 334 (1884) (Figures 10-11, 26) /Eğri yılanpancarı
Holotype: 'Iraq, ad Arcem Semiramidis' (but see note below), Kotschy, cult. Schoenbrunn (holotype W destroyed)
Lectotype: Türkiye: Adana, Kassan Oghlu (Hasanoglu) Gorumse (Gürümze) valley, 21 May 1859, lectotype Kotschy 442, G-BOIS) chosen by Boyce (2006).
Synonyms:
Calla orientalis L., Sp. Pl., ed. 2. 2: 1373 (1763), nom. rej.
Arum carsaami Kunth, Enum. Pl. [Kunth] 3 25 (1841).
Eminium carsaamii (Kunth) Schott, Syn. Aroid. 17 (1856), nom. illeg.
Ischarum carsaamii (Kunth) Schott, Prodr. Syst. Aroid. 67 (1860), nom. illeg.
Biarum bovei var. *carsaamii* (Kunth) Boiss., Fl. Orient. 5: 34 (1882).
Biarum orientale (L.) Druce, Rep. Bot. Exch. Club Soc. Brit. Isles 3: 415 (1913 publ. 1914).
Ischarum crispulum Schott, Prodr. Syst. Aroid. 68 (1860).
Examined Specimens: Türkiye, B6 Adana: Saimbeyli, Himmetli, 12.04.1957, *P.H. Davis 26644* (K 000400399 photo!), **Adana,** Kassan Oghlu (Hasanoğlu), Gorumse (Gürümze) valley, 21 May 1859, Kotschy 442 (G-BOIS, photo!), **C6 Hatay,** Hatay, Belen pass, stony slopes, 740 m, 14.11.2020, *C. Çeçen & M. Balos 1143* (HARRAN!),
Note: *B. crispulum* is morphologically similar to *B. bovei*. It is easily distinguished from *B. bovei* by its narrow, toothed margins and smaller size. It is clearly distinguished from the other species by its synanthetic leaves and narrow, curved, and curled spathe edges. *B. crispulum* was collected by us for the first time after 55 years since the specimen was collected by Cheese in 1967 from Belen Pass in the Amanos Mountains, within the borders of Hatay, Türkiye. The type specimen of *B. crispulum* was investigated and epityped here. Its description was expanded by making measurements on fresh specimens of the species. The female flower dimensions were revealed for the first time it is decied that the tuber was offspringless in this study.

Figure 10. *B. crispulum* türünün A- habitus, B- flower front view, C- flower reproductive organs, D- leaves, E- cob, F- herbarium specimen H- tuber, J- fruit, K- seeds, L- female flower, M- male flower
Şekil 10. B. crispulum ve A- Habitus, B- Çiçeğin ön görünümü, C- Çiçek üreme organları, D- Yapraklar, E- Koçan, F- Herbaryum örneği H- Yumru, J- Meyve, K- Tohumlar, L- Dişi çiçek, M- Erkek çiçek

Şekil 11. Lectotype of *B. crispulum* (G-BOIS, photo!)
Şekil 11. B. crispulum'un lektotipi (G-BOIS, foto!)

6. *Biarum ditschianum* Bogner and P.C.Boyce, Willdenowia 18: 409 (1989) (Figures 12-13, 26) / **Güdük yılanpancarı**
Holotype: Türkiye, Antalya, Xanthos hill; in holes and crevices in limestone, 30 m, 24 IV 1988, Koenen Bonn 22592 (holotype K; isotypes B100217094!, K000400410!, M0198907!, BONN 22592!).
Examined specimens: **C3 Antalya:** Aksu, district Karaçalı, fallow fields, 30 m, 23.04.2021, *C. Çeçen & Balos 1171* (HARRAN!), **Antalya**: Kaş-Kalkan, district Yeşilköy, 30.04.2016, *Yıldırım 3843* (EGE!); Ksantos, 24.04.1988, *Koenen 22592* (B 100217094, photo!), **C4 Konya**: Seydişehir to Tınaztepe, 04.05.2014, *T. Körüklü 20973* (ANK!)
Note: *B. ditschianum* can be easily distinguished from other *Biarum* species by its unusually shaped flower. The spathe is very small and almost imperceptibly reduced above the tube. Its most striking feature is the dark, thick, hollow yellow spadix. None of the other species have this feature.
7. *Biarum eximium* (Schott and Kotschy) Engl., Monogr. Phan. 2: 576 (1879) (Figures 14-15, 26) / **Adanapancarı**
Lectotype: Türkiye: Iter Cilicicum in Tauri alpes "Bulgar Dagh." prope Adana, in via romana versus Minaret Chan, 60 m, 28 ix 1853, *Kotschy 343* (holotype W destroyed, lectotype G-BOIS, isolectotype K000400392!, P02075091!, P01736146!, S06-17893!, MW0734476! MPU014375). (Lectotype designated by Yıldırım et al. (2018).
Synonyms:
Homaida eximia (Schott & Kotschy) Kuntze, Revis. Gen. Pl. 2: 742 (1891)
Ischarum eximium Schott & Kotschy, Oesterr. Bot. Wochenbl. 4: 81 (1854)
Examined specimens: C5 Adana, around Kozan, stony slopes, 85 m, 16.10.2020, *C. Çeçen & M. Balos 1136* (HARRAN!); Kozan, Ağlıboğaz village, steppe, 200 m, 16.10.2020, *C. Çeçen 1137* (HARRAN!); **Adana:** Pozantı to Fındıklı 8 km, 16.04.2010, *Z. Tıraş* (ISTE 103390!) (at leaf); **Mersin:** Silifke, 37 km NW of Silifke, 10.10.1985, *F. Sorger 85-49-1* (W 1991-03021, photo!); Mersin, 04.1896, *Siehe 22* (E 00330073 photo!)
Note: *Biarum eximium* differs from all other species of the subgenus *Ischarum* in that the staminodes are evenly distributed between the male and female flower regions. It is morphologically similar to *Biarum aleppicum*. However, it is distinguished from *B. aleppicum* by the staminodes completely covering the area between the female and male flowers, the purplish and shiny velvety texture of the spathe inner surface, and the stalkless and thicker spadix appendix. The holotype of this species in Vienna has disappeared; a lectotype was determined from the isotypes by Yıldırım (2018).
8. *Biarum davisii* Turill subsp. ***marmarisense*** P.C.Boyce, Aroideana 10(4): 14 (1987) (Figures 16-17, 26) **/Adasucukotu**

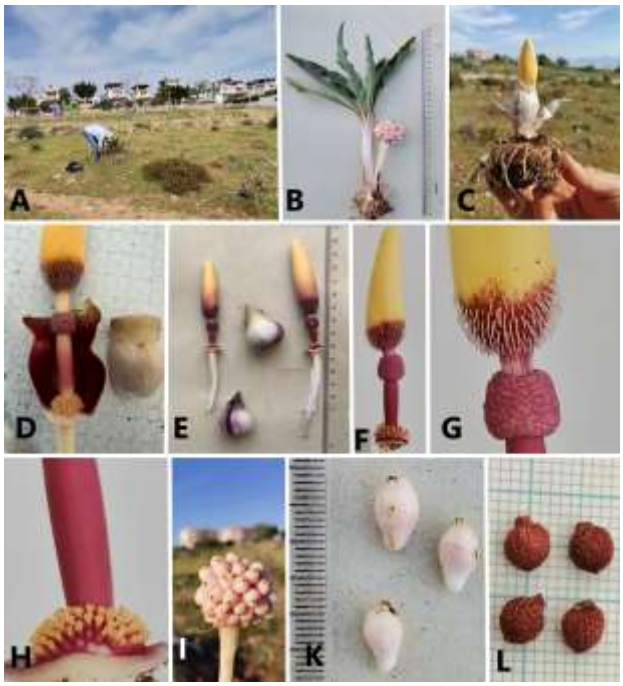

Figure 12. *B. ditschianum* A- habitus, B- flower front view, C- flower reproductive organs, D- leaves, E- cob, F- herbarium specimen H- tuber, J- fruit, K- seeds, L- female flower, M- male flower

Şekil 12. B. ditschianum A- Habitus, B- Çiçeğin ön görünümü, C- Çiçek üreme organları, D- Yapraklar, E- Koçan, F- Herbaryum örneği H- Yumru, J- Meyve, K- Tohumlar, L- Dişi çiçek, M- Erkek çiçek

Figure 13. Isotype of *B. ditschianum* (K000400410)
Şekil 13. B. ditschianum'un izotipi (K000400410)
http://specimens.kew.org/herbarium/K000400410
(© RBG Kew)

Figure 14. *B. eximium* A- habitus, B- flower front view, C- flower reproductive organs, D- leaves, E- cob, F- herbarium specimen H- tuber, J- fruit, K- seeds, L- female flower, M- male flower, N- anters

Şekil 14. B. eximium A- habitus, B- çiçeğin ön görünümü, C- çiçeğin üreme organları, D- yapraklar, E- koçan, F- herbaryum örneği H- yumru, J- meyve, K- tohumlar, L- dişi çiçek, M- erkek çiçek, N- anterler

Figure 15. Lectotype of *B. eximium* (*Kotschy 343*, G-BOIS)
Şekil 15. B. eximium'un lektotipi (*Kotschy 343,* G-BOIS)

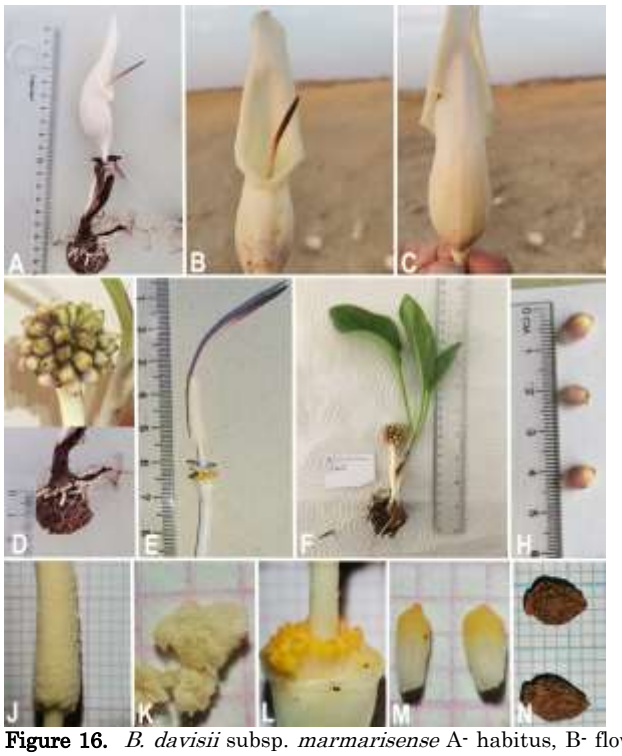

Figure 16. *B. davisii* subsp. *marmarisense* A- habitus, B- flower front view, C- flower reproductive organs, D- leaves, E- cob, F- herbarium specimen H- tuber, J- fruit, K- seeds, L- female flower, M- male flower, N- seeds
Şekil 16. B. davisii subsp. marmarisense A- habitus, B- çiçeğin ön görünümü, C- çiçeğin üreme organları, D- yapraklar, E- koçan, F- herbaryum örneği H- yumru, J- meyve, K- tohumlar, L- dişi çiçek, M- erkek çiçek, N- tohumlar

Figure 17. Isotype of *B. davisii* subsp. *marmarisense* (K000400411)
Şekil 17. B. davisii subsp. marmarisense'nin izotipi (K000400411)
http://specimens.kew.org/herbarium/K000400411
(© RBG Kew)

Holotype: Türkiye: Muğla, Marmaris, Bozburun, Taşlıca köyü, T.Baytop, Zeybek, G.Görk (holotype.: EGE 8796!; **isotype:** ISTE 47726, K000400411!, E00196510!)
Synonym: Biarum marmarisense (P.C.Boyce) P.C. Boyce, Aroideana 29: 34 (2006).
Examined specimens: C2 Muğla, Ortaca, Dere köy village, slopes, steppe, 20 m, 25.10.2020, *C. Çeçen 1141* (HARRAN!); ibid., 20.10.2021, *C. Çeçen 1191* (HARRAN!), **Muğla:** Fethiye, Ölüdeniz, Kelebekler valley, Kozağaç village, 18.10.2015, *Yıldırım 3760*, *3764* (EGE!); Marmaris, Bayır to Söğüt, 18.10.2015, *Yıldırım 3752* and 3754 (EGE!); Bozburun, Taşlıca village 17.10.2013, *S. Aslan 4581* (DUOF 5485); Bozburun, Taşlıca Köyü, 01.11.1981, *T. Baytop* (ISTE-47726).
Note: Boyce, who described the subspecies *Biarum davisii* subsp. *marmariense*, changed its status in his later study (Boyce, 2006) and transferred it to species level as *Biarum marmarisense* (Boyce, 2006 and 2008). Later, this species was reduced to subspecies level as subsp. *marmarisense* by Yıldırım (2018). The specimens we examined confirm this situation. Although Boyce (2008) mentioned the existence of *Biarum davisii* subsp. *marmariense* in Greece, Yıldırım (2018) reports that this information needs confirmation.
9. *Biarum pyrami* (Schott) Engl., Monog. Phanerog. 2: 576 (1879) (Figures 18-19, 26) / **Ağukınası**
Type: Juxta arcem Semeramidis [plantae ad Pyramum (Ceyhan River) in monte Nur lectae: inter Messis (Misis) et castellum Scheih Meran (Yilankale), 60 m, J, Kotschy s.n. (holotype W destroyed, isotypes G (sterile fragments).
Epitype: W. Schott, Icones Aroideae no. 2161 (W!). (designated by Boyce, 2008): Bot. Mag. (Kew Mag.) 209:93 (2008).
Synonyms:
Ischarum pyrami Schott, Prodr. Syst. Aroid. 66 (1860).
Ischarum nobile Schott, Prodr. Syst. Aroid. 66 (1860).
Homaida pyrami (Schott) Kuntze, Revis. Gen. Pl. 2: 742 (1891)
Examined specimens: C2 Muğla: Fethiye, 27.03.1956, *P.H. Davis 25434* (E 00330080, photo!); Fethiye, Ölüdeniz, Karaağaç village, 10.10.2015, *Yıldırım 3746* (EGE!); **C3 Burdur:** Bucak, Üzümlübel village, Kandıra district, stony steppe, 800 m, 18.10.2020, *C. Çeçen & M. Balos 1138* (HARRAN!), **Burdur:** Bucak, Çobanpınar village, 21.10.2004, *A. Güner 13685* (NGBB 2126!), **Antalya:** Akseki, Dederi district, 17.11.1973, *N. Sütlüpınar* (ISTE 27131!); Antalya: Beydağı, S of Avlan Lake, 24.11.1967, *Watson 3901* (K 000400395, photo!); Antalya: Gazipaşa, Şahinlar village, 17.10.2006, *A. Dönmez 14171* (ANK!; G, photo!); Antalya: İbradı, Ürünlü village, *H. Duman 10277* (GAZI!)

Figure 18. *B. pyrami* A- habitus, B- flower front view, C- flower reproductive organs, D- leaves, E- cob, F- herbarium specimen H- tuber, J- fruit, K- seeds, L- female flower, M- male flower, N- seeds
Şekil 18. B. pyrami A- habitus, B- çiçeğin ön görünümü, C- çiçeğin üreme organları, D- yapraklar, E- koçan, F- herbaryum örneği H- yumru, J- meyve, K- tohumlar, L- dişi çiçek, M- erkek çiçek, N- tohumlar

Figure 19. Epitype of *B. pyrami (Schott, icones Aroideae no. 2161, W)*
Şekil 19. B. pyrami'nin epitipi (Schott, Aroideae resimleri no. 2161, W)

Note: *Biarum pyrami* is similar to *B. bovei*. It has a large and showy flower. It is a species that can be easily distinguished from autumn-flowering *Biarum* species by its distinctly swollen tube, broad-based lanceolate spathe and long spadix. There is a sudden narrowing between the spathe tube and the spathe. In some samples collected from the Bucak district of Burdur, it was observed that the leaves were bubbly. This feature is not found in any other species. Koach and Feinbrun (1986), in the 4th volume of Flora of Palestine, described a variety under the name of *B. pyrami* (var. *serotinum* Koach & Feinbrun); Boyce (2008) also accepted the existence of this variety and distinguished it from *B. pyrami* var. *pyrami* by the simultaneous emergence of leaves and inflorescences and the absence of pimple-like blisters on the leaves.

10. ***Biarum rifatii*** Yıldırım & Altıoğlu, Bagbahçe Bilim Derg. 3(2): 13 (2016) (Figures 20-21, 26) /**Rıfat sucukotu**
Holotype: Türkiye: Antalya: Kaş, Palamut village, between Ağaçlı Akgedik plateau and Rahat plateau, mountain slopes, 1800-2000 m, 20 vi 2016, *Yıldırım 3927* (holotype: EGE-42437!, isotype: EGE-42438!, NGBB!, ANK!)
Examined specimens: C2 Antalya: Kaş, Palamut village, mountain steppe, 1600 m, 24.04.2021 *C. Çeçen &Balos 1174* (at leaf) (HARRAN!); ibid., 1800-1900 m, 17.06.2021, *C. Çeçen 1179* (HARRAN!), **Antalya:** Kaş, Palamut village, 20.06.016, *Yıldırım* (EGE!; ANK!; HUB!).
Note: It has no close relatives. It is a species characterized by the emergence of the inflorescence in June, the absence of sterile flowers, and the entire interior of the sphata tube being bright purple. *B. rifatii* is quite different from other species by flowering at high altitudes (2000 m) in June (Yıldırım & Atlıoğlu, 2016). It shows some morphological similarities with *B. pyrami* (Yıldırım, 2018). However, it can be distinquished from *B. pyrami* by not having sterile flowers. It is a local endemic to Türkiye, around Antalya.

11. ***Biarum syriacum*** (Spreng.) Riedl**,** Aroideana 3: 19 (1980) (Figures 22-23, 26) /**Arap sucukotu**
Lectotype: Syria, prope Aleppo, Russell s.n. (Lectotype BM000848535!).
Isolectotype: Syria: prope Aleppo, *Russell s.n* (P02133553!).(**isolectotype** designed here).
Synonyms:
Biarum gramineum Banks & Sol., A.Russell, Nat. Hist. Aleppo, ed. 2, 2: 264 (1794), nom. superfl.
Arum syriacum Spreng., Syst. Veg., ed. 16. 3: 768 (1826)
Biarum russellianum Schott, Prodr. Syst. Aroid.: 63 (1860), nom. superfl.
Homaida russelliana (Schott) Baill., Hist. Pl. 13: 456 (1895)
Arum gramineum Sol., Nat. Hist. Aleppo, ed. 2 [A. Russell] 2: 264 (1794).
Biarum gramineum (Banks & Sol.) Eig, J. Bot. 75: 189 (1937).

Figure 20. *B. rifatii* A- habitus, B- flower front view, C- flower reproductive organs, D- leaves, E- cob, F- herbarium specimen H- tuber, J- fruit, K- seeds, L- female flower, M- male flower, N- female flower

Şekil 20. B. rifatii A- Habitus, B- Çiçeğin ön görünümü, C- Çiçek üreme organları, D- Yapraklar, E- Koçan, F- Herbaryum örneği H- Yumru, J- Meyve, K- Tohumlar, L- Dişi çiçek, M- Erkek çiçek, N- Dişi çiçek

Figure 21. Holotype of *Biarum rifatii* (EGE 42437!)

Şekil 21. Biarum rifatii'nin holotipi (EGE 42437!)

Figure 22. *B. syriacum* A- habitus, B- flower front view, C- flower back part, D- tuber, E- fruit, F- female flower, H- male flower, J- spadix and scape, K-fruit, L-seeds, M twhole plant, N- part that carries the reproductive organs, O-capsule

Şekil 22. B. syriacum A- Habitus, B- Çiçeğin ön görünümü, C- Çiçeğin arka kısmı, D- Yumru, E- Meyve, F- Dişi çiçek, H- Erkek çiçek, J- Spadix ve çiçek sapı, K- Meyve, L- Tohumlar, M Tüm bitki, N- Üreme organlarını taşıyan kısım, O- Kapsül

Figure 23. Holotype of *B. syriacum* (P02133553)

Şekil 23. B. syriacum'un holotipi (P02133553)

http://coldb.mnhn.fr/catalognumber/mnhn/p/p02133553

Examined specimens: C6 Gaziantep: Dülükbaba forest, 8 km of Gaziantep, 1100-1200 m, 19.04.2021, *C. Çeçen &Balos 1168* (HARRAN!), ibid., 01.05.2005, *Akan 5565 & Balos* (HARRAN!); ibid., 23.04.2015, *Yıldırım 3180* &*Balos* (EGE!).

Note: *Biarum syriacum* has a very different structure compared to other species. It blooms in the leafy period in spring. The leaves are arranged to surround the flower part. It has no close relatives.

The original of the specimen whose drawing was labeled as Holotype by P. Boyce in the BM herbarium is in the Paris herbarium with the barcode number P02133553. For this reason, the specimen numbered P02133553 was selected as Epitype instead of a drawing.

12. ***Biarum tenuifolium*** (L.) Schott subsp. ***zelebori*** (Schott) P.C.Boyce in R.H.A.Govaerts & D.G.Frodin, World Checkl. & Bibliogr. Araceae: 245 (2002) (Figures 24-26) / **Sucukotu**

Lectotype: Türkiye, prope Smyrnam (Izmir). Zelebor s.n. (holotype W destroyed; lectotype W (Schott's leones Aroideae no. 1532). Lectotype designed by Boyce (2006).

Epitype: Türkiye: prope Smyrnam (Izmir). Lydia., Bornmüller, J.F.N. 10033 (B100217078!) Epitype designed here.

Synonyms:

Biarum zeleborii Schott, Oesterr. Bot. Wochenbl. 7: 245 (1857)

Biarum tenuifolium var. *zelebori* (Schott) Engl., A.L.P.P.de Candolle & A.C.P.de Candolle, Monogr. Phan. 2: 574 (1879)

Examined specimens: B2 İzmir: Bornova, 1933, *O. Schwarz 698* (B 100217077 photo!); İzmir, Ilıca, 29.05.1906, *Bornmueller 10033* (K 000400419, photo!); Menderes to Gümüldür, Deliömerler district, 1603.2017, *Yıldırım 4256* (EGE!); **Muğla:** Bodrum, Çömlekçi village, 24.06.2001, *Ertuğ* (NGBB!); **C2 Aydın**; Bozdoğan–Yatağan, 15 km after Bozdoğan, 650-700 m, 25.04.2021, *C. Çeçen 1175 & Balos* (at leaf) (HARRAN!); Aydın, Inside and around the ancient city of Nisa (Nysa), in olive groves, 210-230 m, 25.04.2021, *C. Çeçen 1176 & Balos* (HARRAN!); **Aydın:** Bozdoğan-Yatağan, 10 km after Bozdoğan, 31.03.2017 (at leaf), *Yıldırım* 4505 (EGE!); Sultanhisar, Aydın to Nazilli, 03.04.1956, *Davis 25589* (E 00330085, photo!).

Note: The most important feature that distinguishes this species from others is the presence of the sterile area on both the male and female flower parts. In other species, the sterile area is only on the female flowers. The presence of a thick spadix that extends well beyond the spathe is also an important distinguishing feature. It is a highly diverse species with 6 subspecies worldwide. *B. tenuifolium* subsp. *zelebori* is distinguished from other subspecies by its large and wide palm and thicker appendix.

Figure 24. *B. tenuifolium* subsp. *zelebori* A- habitat, B- flower front part, C- flower side position, D- leaves, E- fruit cob and tuber, F- part carrying reproductive organs, H- tuber, J- anthers, K- fruit, L- seed, M-female flower

Şekil 24. B. tenuifolium subsp. zelebori A- habitat, B- çiçeğin ön kısmı, C- çiçeğin yan pozisyonu, D- yapraklar, E- meyve koçanı ve yumru, F- üreme organlarını taşıyan kısım, H- yumru, J- anterler, K- meyve, L- tohum, M- dişi çiçek

Figure 25. Epitype of *B. tenuifolium* subsp. *zelebori (B100217078)*
Şekil 25. B. tenuifolium subsp. zelebori türü epitipi (B100217078) https://herbarium.bgbm.org/object/B100217078

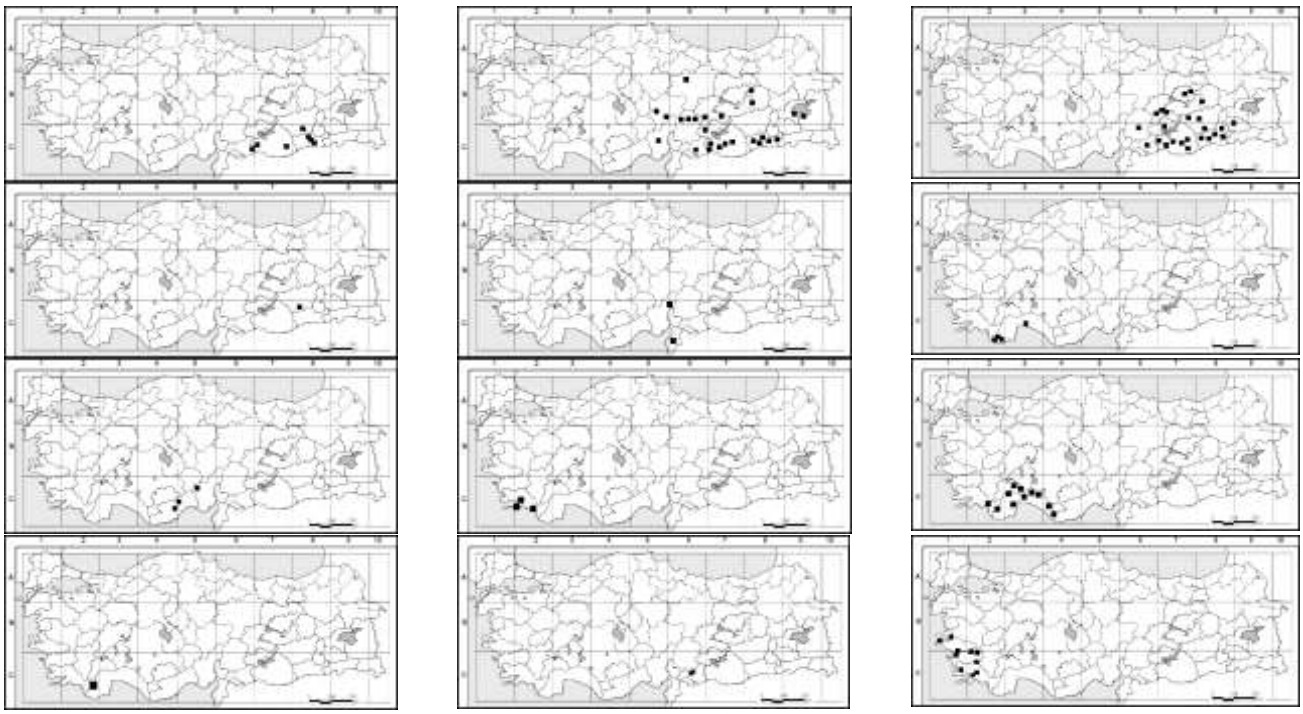

Figure 26. Distribution map of *Biarum* members in Türkiye A) *B. aleppicum* B) *B. bovei* C) *B. carduchorum* D) *B.* x *cinarense* E) *B. crispulum* F) *B. ditschianum* G) *B. eximium* H) *B. davisii* subsp. *marmarisense* I) *B. pyrami* J) *B. rifatii* K) *B. syriacum* L) *B. tenuifolium* subsp. *zelebori*

Şekil 26. Biarum üyelerinin Türkiye'deki dağılım haritası A) B. aleppicum B) *B. bovei* C) *B. carduchorum* D) *B. x cinarense* E) *B.c rispulum* F) *B. ditschianum* G) *B. eximium* H) *B. davisii* subsp. *marmarisense* I) *B. pyrami* J) *B. rifatii* K) *B. syriacum* L) *B. tenuifolium* subsp. *zelebori*

DISCUSSION

In this study, a synopsis of the *Biarum* genus distributed in Türkiye was given. Both population of endemic species was determined and samples that can be known only from the type were collected and taken to herbaria. The diagnostic keys have been rearranged. Each statu of members is given below:

Biarum davisii subsp. *marmariense*, was described as subspecies by Boyce, later elevated it to species level (Boyce, 2006 and 2008). Although he used the appendix width of subsp. *marmarisense* in the distinction, studies at the population level showed that the appendix was not as thin as Boyce stated (0.5 mm), on the contrary, this situation was seen quite rarely, with spadix appendix mostly 2 mm in diameter (Yıldırım, 2018). The specimens examined by us confirmed this situation. Although Boyce (2008) mentioned the existence of *Biarum davisii* subsp. *marmariense* in Greece, Yıldırım (2018) reports that this information needs confirmation.

In this study, it's confirmed that *Biarum pyrami* populations in Türkiye have a blister.

Fruit number, seed dimensions and female flower length were revealed for the first time for *Biarum rifatii* in this study.

In this study, the description of the species *Biarum syriacum* was expanded. Its presence in the Flora of Turkey was noticed by Akan and Balos (2008) when it was collected from Gaziantep. Fruit cob, fruit number and seed sizes were determined for the first time.

For the *Biarum ditschianum*, it was revealed for the first time that the tuber had offspring.

Differences were observed in fruit size and seed dimensions of *Biarum crispulum* when compared with the studies of Yıldırım (2018) and Boyce (2008).

It was seen that there were differences in leaf limb, leaf petiole, scap length, spathe limb, fruit number and seed dimensions for *Biarum pyrami* when compared with the study of Yıldırım (2018) and Boyce (2008). The number of cataphylls was not mentioned in previous studies and was determined for the first time in this study.

It was observed that the tuber size, number of leaves, leaf stalk length, leaf limb, spathe length, spathe limb, spathe tube, appendix, male flower area, fruit cob, number of fruits, and fruit size measurements were higher for *Biarum eximium* than previous studies (Boyce, 2008; Yıldırım, 2018) It was revealed for the first time that the tuber had offspring and the inner surface of the spathe was bright velvety red and had white dots.

It was seen that the style, fruit cob, fruit size, fruit number, and seed dimensions of *B. tenuifolium* subsp. *zeleborii* were not given by Yıldırım (2018) and Boyce (2008). When compared with Boyce (2008), it was seen that there were differences in the measurements. The main reasons for the differences may be the effect of different habitats, the number of samples studied, and the result of working on dried samples.

The holotype of *Biarum eximium* in Vienna has disappeared; a lectotype was determined from the isotypes by Yıldırım (2018). Boyce (2008) states that *Biarum eximium* should be collected from Adana, the type locality. Although Boyce (2008) stated that this species was found in Jordan based on the Dinsmore 11725 (E 00330074, photo!) specimen, Yıldırım (2018) stated that this specimen is not *B. eximium* but it should be a variation of *B. bovei* because the structure of the spathe palm is narrowly lanceolate, and the intermediate region is not completely covered with sterile flowers. In our examination, it was seen that this specimen was not *B. eximium* as stated by Yıldırım (2018), and in addition, the leaf structure and style were different from those of *B. eximium*. Boyce stated that a specimen (Al-Eisawi 8861) collected by Al-Eisawi (1981) from 50 km south of Amman and located in the Jordan University Herbarium (AMM) could be *B. eximium*. He also stated that he had not seen this specimen but examined the fresh plants collected by Salmon and Lovell in 1988, who were very close to the same region. He desired that the species *B. eximium* should be collected especially from Adana, Türkiye. Based on the data we obtained, it was seen that the literature records by Boyce (2008) remained far from *B. eximium*. 170 years later, with this study, this confusion was eliminated. Measurements were made on our fresh samples collected from Adana province, and their description was expanded.

Biarum kotschyi was made a synonym of *Biarum bovei* by Yıldırım (2018).

Biarum× cinarense was published as a new natural hybrid from Türkiye by Çeçen et al. (2022), and it is added to the identification key in this study.

The holotype of the *Biarum carduchorum* has become extinct. The lectotype was determined by Boyce (2006). Observations and examinations of collected specimens showed that the species showed a wide variation, especially the length of the spathe limb and spadix, and the length and density of the staminodes in the sterile region were different. In some specimens, it is similar to *B. angustatum* in terms of the staminodes being directed downwards. In some specimens, both the downward and upward staminodes are in the same individual, making species identification difficult. In some collected specimens, it was observed that the outer surface of the spathe limb was canalized, and the male flower region was purplish rather than yellow. A phylogenetic population-level study is needed on *B. carduchorum*.

Some taxonomical notes obtained from this study are given for some taxa and compared with some previous studies, are given below:

The comparison of the findings of the *B. aleppicum* species with the studies of Yıldırım (2018) and Boyce (2008) is given in Table 1.

Tuber offspring, fruit cob, fruit number, fruit size, and seed measurement of *Biarum aleppicum* were not given in the study of Yıldırım (2018). It was observed that the fruit diameter and length were larger, and the style length was longer than in the study of Boyce (2008). Other differences related to *B. aleppicum* are given in Table 2.

The comparison of the *B. bovei* with previous studies is given in Table 2.

Table 1. Comparison of morphological findings for *B. aleppicum* with previous studies
Çizelge. B. aleppicum için morfolojik bulguların önceki çalışmalarla karşılaştırılması

Characters /*Karakterler*	This study /*Bu çalışma*	Yıldırım (2018)	Boyce (2008)
Tuber offspring /*Tuber yavruları*	present	not given	not given
Cataphyll number/*Katafil sayısı*	4-25	4-20	5–7
Spadix length (cm)/ *Spadiks uzunluğu (cm)*	7-16	10–12	11–12
Sterile flower area length (mm)/ *Steril çiçek alanı uzunluğu (mm)*	13-20	14–16	16
Male flower area length (mm)/ *Erkek çiçek alanı uzunluğu (mm)*	10-24	12-15	
Fruit cob (diameter x length cm)/ *Meyve koçanı (çap x uzunluk cm)*	2-5 x 2.5-3.5	-	c. 12
Fruit number/ *Meyve sayısı*	20-40	-	c.2 cm dia.
Fruit size (diameter x length mm)/ *Meyve boyutu (çap x uzunluk mm)*	9-11 x 14-16	-	4 × 5
Seed (diameter x width mm)/ *Tohum (çap x genişlik mm)*	5 x 6	-	5 × 5-6

Table 2. Comparison of morphological findings for *B. bovei* with previous studies
Çizelge 2. B. bovei için morfolojik bulguların önceki çalışmalarla karşılaştırılması

Characters/*Karakterler*	This study *Bu çalışma*	Yıldırım (2018)	Boyce (2008)
Leaf stalk (length/cm)/ *Yaprak sapı (uzunluk/cm)*	7-19	8-16	5–9
Scape length (cm)/ *Skapoz uzunluğu (cm)*	3-17	3-14	4–7
Spadix length (cm)/ *Spadix uzunluğu (cm)*	10-16	7-15.5	9–14
Female flower (length x width / mm)/ *Dişi çiçek (uzunluk x genişlik / mm)*	3-3.2	-	-
Fruit cob (diameter x length/ cm)/ *Meyve koçanı (çap x uzunluk/ cm)*	5-5.5	-	2.5–3
Fruit size (Diameter x length/ mm)/ *Meyve boyutu (Çap x uzunluk/ mm)*	13-16 × 9-11	-	7 × 4

The fruit and seed sizes, and the style length of *B. bovei* were not given in the study of Yıldırım (2018). It was observed that the fruit cob diameter was larger, the diameter and length of the fruit were larger, and there were

differences in seed dimensions. Female flower dimensions were revealed for the first time.
Biarum members in Türkiye are generally spread on stony areas and open slopes, the altitudes vary (10-2100 m), their flowering periods generally occur in autumn, spring, and early summer months, 75% of the taxa are in the Mediterranean and 25% in the Irano-Turan regions as phytogeographic regions.
The short history of the genus in Türkiye is given in Table 3.

Table 3. Short history of *Biarum* genus in Türkiye
Çizelge 3. Türkiye'de Biarum cinsinin kısa tarihi

Name of study/*çalışma adı*	Taxa numbers *Takson sayısı*	Taxa names/*Takson adı*
Flora of Turkey 8th vol (Mill, 1984) *Türkiye Florası 8.cilt (Mill, 1984)*	6	*Biarum tenuifolium* subsp. *zelebori, B. davisii*, *B. carduchorum*, *B. eximium*, *B. pyrami* and *B. bovei*.
A new subspecies of *Biarum* from Turkey (Boyce, 1987). *Türkiye'den yeni bir Biarum alttürü (Boyce, 1987)*	1 taxa added	*Biarum davisii* subsp. *marmarisensis*
A remarkable new *Biarum* from Türkiye (Bogner and Boyce, 1989) *Türkiye'den dikkate değer yeni bir Biarum (Bogner ve Boyce, 1989)*	1 species added	*Biarum ditschianum*
A new record of *Biarum* for Flora of Türkiye (Akan and Balos, 2008) *Türkiye Florası için Biarum'un yeni bir kaydı (Akan ve Balos, 2008)*	1 species added	*Biarum syriacum*
A taxonomic revision of *Biarum* (Boyce, 2008) *Biarum'un (Boyce, 2008) taksonomik revizyonu*	1 new stat. nov.	stat. nov. for *Biarum davisii* subsp. *marmarisense* (Become synonym of *Biarum marmarisense*)
A new record for Türkiye (Yıldırım et al., 2016) *Türkiye için yeni bir rekor (Yıldırım ve ark., 2016)*	1 species added	*Biarum aleppicum*
A new *Biarum* species from Türkiye (Yıldırım and Altıoğlu, 2016) *Türkiye'den yeni bir Biarum türü (Yıldırım ve Altıoğlu, 2016)*	1 species added	*Biarum rifatii*
The Illustrated Flora of Türkiye (Yıldırım, 2018) *Resimli Türkiye Florası (Yıldırım, 2018)*	1 new stat. nov.	*Biarum davisii* subsp. *marmarisensis* was accepted at subspecies level again.
The Illustrated Flora of Türkiye (Yıldırım, 2018) *Resimli Türkiye Florası (Yıldırım, 2018)*	1 new stat. nov.	stat. nov. for *Biarum kotschyi* (Become synonym of *B. bovei*)
A new natural hybrid from Türkiye (Çeçen et al., 2022) *Türkiye'den yeni bir doğal melez (Çeçen ve ark., 2022)*	1 species added	*Biarum* × *cinarense*

As can be seen from Table 1, after taxonomical changes that have occurred since the publication of Flora of Turkey, *Biarum* genus has 12 taxa in Türkiye now.
Five taxa of the genus are endemic, and the endemism rate is 41.6% in Türkiye. These endemic members are *Biarum* x *cinarense, B. ditschianum, B. davisii* subsp. *marmarisense, B. rifatii* and *B. eximium*. Due to the smaller number of individuals in locations and populations, they should be evaluated in the "EN" risk category. Among the non–endemic members, *B. aleppicum*, *B. bovei,* and *B. carduchorum* should be evaluated in the "LC" risk category; *B. eximium*, *B. crispulum*, *B. ditschianum*, and *B. syriacum* should be evaluated in the "EN" risk category; *B. pyrami* and *B. tenuifolium* subsp. *zelebori* should be evaluated in the "NT" category.
It is believed that this study makes contributions to the Illustrated Flora of Türkiye and provides additional notes to the *Biarum g*enus in Türkiye.

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The authors declare that they have contributed equally to the article.

Conflict of Interest

The authors of the articles declare that they have no conflict of interest.

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