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Taxonomic, nomenclatural and floristic review of *Amaranthaceae* of Greece and neighbouring countries

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Abstract: The history and progress of floristic knowledge on *Amaranthaceae* occurring in Greece and adjacent Balkan countries are briefly outlined and changes in family circumscription and generic delimitation are addressed. The new combinations *Amaranthus blitoides* [var. *blitoides*] f. *thellungii* (Sennen ex Thell.) Raus and *A. blitoides* [var. *reverchonii*] f. *densifolius* (Uline & W. L. Bray) Raus are published. The names *Achyranthes argentea* Lam. and *Amaranthus commutatus* A. Kern. ex Hayek are lectotypified, the former a synonym of *Achyranthes sicula* (L.) All , the latter of *Amaranthus blitum* L. *Amaranthus commutatus* A. Kern. has long been known as a designation with no nomenclatural value for a fictitious taxon but is still erroneously accepted in current floristic online sources.

Keywords: *Achyranthes*, *Amaranthaceae*, *Amaranthus*, Balkan Peninsula, Greece, lectotypification, new combination, nomenclature, *Polycnemum*, taxonomy

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Introduction

The latest account on *Amaranthaceae* occurring in Greece (Raus 1997) was published 25 years ago as a contribution to the former *Flora hellenica* project which was dropped by its Steering Committee after the publication of volumes 1 and 2 (Strid & Tan 1997; 2002) and remained incomplete. A revised treatment of *Amaranthaceae* for a subsequently tackled, forthcoming *Flora of Greece* project (Dimopoulos & Constantinidis 2019) has to consider recent progress in both molecular phylogeny of *Amaranthaceae* and floristic exploration of the S Balkan Peninsula.

Materal and methods

All literature sources of the past two centuries (from 1816 to 2022) referring to the occurrence of *Amaranthaceae* in the S Balkan countries were critically surveyed and many recent, in particular unpublished herbarium collections of *Amaranthaceae* from Greece including the rich Willing collections kept in B, were checked by the present author in order to develop an updated taxonomic, nomenclatural and floristic basis for an emended *Amaranthaceae* treatment to be incorporated into the forthcoming *Flora of Greece* project. This new family account (in process) will also contain a revised determination key streamlined by various new insights meanwhile gained after Raus (1997). The present paper concentrates on matters of taxon delimitation, floristic exploration history and clarification of disputed taxonomic and nomenclatural aspects, which are beyond the scope of the planned flora. The *International Code of Nomenclature for algae, fungi, and plants* (Turland & al. 2018) is cited as "*Shenzhen Code*" hereafter. Herbarium acronyms follow Thiers (2022+). Chorological data on native and secondary total ranges of weedy amaranths are preferentially taken from Bayón (2015) and references therein.

Family circumscription and orthography

The earliest mention of a member of *Amaranthaceae* from Greece (Smith 1816) happened 63 years after Linnaeus's *Species plantarum* (Linnaeus 1753). Since then the circumscription of the family underwent various bidirectional changes with regard to its separation from the closely related *Chenopodiaceae*. The main driver for this is the subfamily *Polycnemoideae*, which shares similarities with both those two families. In molecular studies, *Polycnemoideae* are resolved as a well-supported monophyletic lineage, albeit with some conflict regarding their position within the "*Amaranthaceae–Chenopodiaceae*

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alliance" (Masson & Kadereit 2013). Early monographers such as Endlicher (1837) and Moquin-Tandon (1849), followed by Boissier (1879) and Halácsy (1904), considered *Polycnemoideae* as an integral part of *Amaranthaceae* s.str., whereas Hooker (1880: 20, 23) included *Polycnemoideae* in *Chenopodiaceae*, followed by Thellung (1914), Hayek (1924), Strid & Tan (1997) and Strid (2016). *Polycnemoideae* were resolved as sister to *Amaranthaceae* s.str. by Kadereit & al. (2003; 2012) or as sister to *Amaranthaceae* plus *Chenopodiaceae* by Müller & Borsch (2005). However, *Polycnemoideae* are never resolved as sister to or within *Chenopodiaceae*, where they were traditionally placed (e.g. Ulbrich 1934; Kühn & al. 1993). Consequently, Hernández-Ledesma & al. (2015: 303) reinstalled the first-mentioned family concept of Endlicher, Boissier and Halácsy, corroborated by recent molecular phylogenetic insight. Application of the name *Amaranthaceae* to the complete *Amaranthaceae–Chenopodiaceae* alliance, proposed by APG (1998) and adopted in subsequent versions of the APG classification, seems therefore not advisable. What the future holds in terms of ideas of relationships will determine the fate of the suggested classification of *Amaranthaceae* s.lat. (Stevens 2022). Due to their proven monophyly, the core *Chenopodiaceae* (Zhu & Sanderson 2017) are accordingly maintained here as a family distinct from *Amaranthaceae*, and *Polycnemoideae* are integrated in the latter.

Influential authors like Moquin-Tandon (1849) and Thellung (1914), followed by the basic Balkan floristic sources of Boissier (1879), Halácsy (1904), Hayek (1924) and Rechinger (1944), tried to propagate the etymologically correct orthography "*Amarantus*" ("*Amarantaceae*") in order to replace Linnaeus's original spelling (Linnaeus 1753), and Linnaeus himself sporadically switched over to this orthographic variant (Linnaeus 1759: 1268–1269). This, however, is not concordant with the *Shenzhen Code*, where it is accordingly rejected by Art. 60 Ex. 1, but has left numerous plant names with their orthographical variants at various taxonomic levels in previous literature.

Genus and species delimitation

The early monographer Moquin-Tandon (1849) separated the amaranths then known from Europe into two genera, *Amaranthus* L. (s.str.; perianth segments (3–)5, fruits transversely dehiscent) and *Euxolus* Raf. (perianth segments 3(–5), fruits indehiscent), the latter genus replaced with *Albersia* Kunth in current use soon after. Two additional generic segregates accepted by Moquin-Tandon and native to the Americas, viz. *Mengea* Schauer (with *M. californica* Moq. ≡ *Amaranthus californicus* (Moq.) S. Watson, casual alien in Poland) and *Scleropus* Schrad. (with *S. crassipes* (Schltdl.) Moq. ≡ *Amaranthus crassipes* Schltdl., casual alien in Italy), have not yet reached the Balkan countries (Iamonico 2015a, 2016c). The separating floral and carpological characters used by Moquin-Tandon, however, proved unsuitable for the separation of generic segregates from *Amaranthus* (Thellung 1914: 228–229). Nevertheless, the names *Albersia blitum* (L.) Kunth, "*A. caudata*" misapplied (= *Amaranthus viridis* L.), *Albersia deflexa* (L.) Fourr., "*Euxolus caudatus*" misapplied (= *Amaranthus viridis*), *E. deflexus* (L.) Raf., *E. lividus* (L.) Moq., *E. muricatus* Gillies ex Moq. and "*E. viridis*" misapplied (= *Amaranthus blitum* L.) were used in 19th century floristic literature on Greece (e.g. Heldreich 1862, 1882; Boissier 1879; Haussknecht 1897), all of them synonyms of various species in *Amaranthus*. Taxa in *Amaranthus* that evolved by domestication share many morphological characters with their wild progenitors. Due to their different origin and independent evolutionary history they are maintained as separate species in horticultural, agricultural, floristic as well as recent molecular phylogenetic literature (e.g. Chan & Sun 1997; Raus 1997; Mosyakin & Robertson 2003; Bayón 2015; Iamonico 2015a, b; Waselkov & al. 2018). On the contrary, the deviating concept of sinking names of putative wild progenitors into mere synonymy of their domesticated descendants (Greuter 1981; Greuter & al. 1984) has presumably caused, and will continue to cause, much floristic confusion and omission of taxa in future Balkan flora and atlas projects. *Achyranthes* L. and *Polycnemum* L., the two further *Amaranthaceae* genera reported from Greece, are comparatively undisputed in their generic circumscription.

Floristic knowledge on *Amaranthaceae* in Greece and adjacent countries

Twenty-two *Amaranthaceae* taxa at specific rank have been reported from Greece according to the current state of floristic knowledge (Halácsy 1902; Raus 1997, 2006; Raus & Raabe 2006). In Table 1 they are listed on an ascending time scale of first publication or oldest voucher seen by the present author and arranged in synoptic columns of major basic floras showing the stepwise floristic progress. The first taxon reported from Greece was *Amaranthus graecizans* subsp. *silvestris* (Vill.) Brenan, collected by John Sibthorp and his fellow travellers in the 1790s (Smith 1816: 235, as "*A. blitum*" misapplied). The next record was that of *Achyranthes sicula* (L.) All., collected by Christian Gottfried Ehrenberg around 1820 in Rodos. *Amaranthus blitum* L., *A. prostratus* Bellardi ex Balb. (= *A. deflexus* L.) and *A. retroflexus* L. were added by Grisebach (1846), communicated to him by his corresponding contributors Emerich Frivaldszky von Frivald and Emanuel Ritter von Friedrichsthal in the 1830s, when the latter also collected *A. hypochondriacus* L., until then not reported from Greece (specimen in W!). Shortly after, in the 1850s, *A. albus* L. and *A. hybridus* L. were first reported by Theodor H. H. von Heldreich and Theodoros

G. Orphanides to Pierre Edmond Boissier, who published the records in the fourth volume of his *Flora orientalis* (Boissier 1879). Only after Boissier's milestone flora was the genus *Polycnemum*, with two species *P. arvense* L. and *P. majus* A. Braun ex Bogenh., found in Greece in the late 1880s (Halácsy 1890; Haussknecht 1897). Three more amaranths were mentioned in literature or found deposited in herbaria of the 1890s, viz. *A. caudatus* L., *A. cruentus* L. and *A. viridis* L. The first amaranth added to the flora of Greece in the 20th century was *A. blitoides* S. Watson, collected on the Balkan front of World War I in 1917 (*Wilson & al.*, BM!). More than half a century later, in the period from 1968 to 1990, *A. bouchonii* Thell., *A. emarginatus* Salzm. ex Uline & W. L. Bray, *A. muricatus* (Gillies ex Moq.) Hieron., *A. powellii* S. Watson, *A. quitensis* Kunth and *A. spinosus* L. were identified as occurring in Greece (for details, see Table 1). Lastly, the latecomers of the 21st century in this floristic historical survey were *A. palmeri* S. Watson (Raus & Raabe 2006) and *A. watsonii* Standl. (Raus 2006) from Peloponnisos, two members of the dioecious *A.* subg. *Acnida* (L.) K. R. Robertson (Mosyakin & Robertson 1996). Four more amaranths have been reported from countries adjacent to Greece, namely *A. commutatus* A. Kern. and *A. scleropoides* Uline & W. L. Bray (Bulgaria), *A. crispus* (Lesp. & Théveneau) A. Braun ex J. M. Coult. & S. Watson (North Macedonia, Bulgaria) and *A. tricolor* L. (Turkey-in-Europe). All mentioned taxa are commented on in alphabetical order in the following treatment, taking into account corrections of mistakes found in pertinent literature.

1. *Achyranthes sicula* (L.) All., Auct. Syn. Meth. Stirp. Hort. Regii Taur.: 41. 1773 ≡ *Achyranthes aspera* var. *sicula* L., Sp. Pl.: 204. 1753. – Lectotype (designated by Iamonico 2014a: 416): Herb. Linn. No. 287.1 (LINN).

= *Achyranthes argentea* Lam., Encycl. 1: 545. 1785 ≡ *Achyranthes aspera* var. *argentea* (Lam.) Boiss., Fl. Orient. 4: 993. 1879. – **Lectotype (designated here):** Europe, France, H[ortus] R[egius] Parisiensis (SEV SEVH4073, verified by F. J. Salgueiro & S. Talavera in sched. 1998; image available at https://plants.jstor.org/stable/10.5555/al.ap.specimen.sev-h4073).

Remarks — Lamarck (1785: 545) based the description of *Achyranthes argentea* on plants cultivated in the Royal Botanic Garden of Paris and seen by him in the living state ("cultivé au Jardin du Roi, (*v. v.*)"). Salgueiro & Talavera (SEVH4073, in sched., unpubl.) were the first to identify a specimen from the Royal Botanic Garden in Paris now kept in Sevilla as material suitable for lectotypification of the name but failed to formally fulfil the requirements of *Shenzhen Code* Art. 7.11.

Achyranthes sicula was collected once, around 1820, by Christian Gottfried Ehrenberg on Rodos, the plant probably having escaped from cultivation (Rechinger 1944: 125); it was never recollected since and was therefore deleted from the current checklist of Greek vascular plants (Dimopoulos & al. 2013; Raus 2016). The plate no. 244 of *A. argentea* in Sibthorp's *Flora graeca* does not refer to a Greek locality but shows a plant from Sicily, found by John Sibthorp in the early summer of 1786 (Strid & Strid 2010: 88–89).

2. *Amaranthus albus* L., Syst. Nat., ed. 10: 1268. 1759. – Lectotype (designated by Raus 1997: 143): Herb. Linn. No. 1117.1 (LINN).

Remarks — *Amaranthus albus* is native to S North America, in the U.S.A. (California to Virginia) and NE Mexico; it is introduced as an agricultural weed and ruderal alien in Eurasia, N Africa, South America and Australia (Bayón 2015: 303; Palmer 2009). In the Mediterranean area, the earliest records are from the 1720s (Thellung 1914: 286), whereas the first record in Greece was in the 1850s (see Table 1); the species is now naturalized all over Greece (Strid & Tan 1997: map 265; Arianoutsou & al. 2010) as well as in Albania, North Macedonia, Bulgaria and Turkey (Iamonico 2015a).

3. *Amaranthus blitoides* S. Watson in Proc. Amer. Acad. Arts 12: 273. 1877. – Lectotype (designated by Fernald 1945: 139): North America, U.S.A., Iowa, Ames, gravelly or sandy soils especially around buildings and along roads, *Bessey* (GH GH00036983).

Remarks — *Amaranthus blitoides* is native to C North America (U.S.A.: Michigan to Texas, see Mosyakin & Robertson 2003); it is introduced and naturalized elsewhere in North and South America, Africa and temperate Eurasia (Jalas & Suominen 1980: 94; Bayón 2015: 306). The species is occasionally considered invasive as a strong competitor causing threats in cultivated fields by loss of crop yield, or decreasing the floristic richness of ecosystems by forming cohesive stands (see, e.g., Iamonico 2015b). It was first recorded in Greece in 1917 (see Table 1). The flowering and fruiting period of *A. blitoides* may extend to about eight months in Greece, which may be one reason for its successful spread and naturalization (Strid & Tan 1997: map 266; Arianoutsou & al. 2010); regular winter-flowering has been observed in December and January (Gilli 1977; Raus 1994). Naturalized also in Albania, North Macedonia, Bulgaria and Turkey (Iamonico 2015a), the species is ranked among the most widespread alien vascular plants in Europe (Pyšek & al. 2009: 50, t. 4.3).

Greek material is represented by two varieties, the widespread *Amaranthus blitoides* var. *blitoides* and the more scattered *A. blitoides* var. *reverchonii* Uline & W. L. Bray. Both varieties are scarcely discernible in autumnal plants with habitat-induced very small and dense, spirally arranged foliage (leaf blades 0.6–1.0 cm long), referred to as *A. blitoides* var. *thellungii* (Sennen ex Thell.) Thell. or *A. blitoides* var. *densifolius* Uline & W. L. Bray in literature (Uline & Bray 1894; Sennen 1912).

They merit at most the taxonomic rank of form, which is proposed here. The shape of the leaf blade is usually obovate to elliptic-spathulate and 1.5–2 times as long as wide in *Amaranthus blitoides* f. *thellungii* vs oblong-lanceolate and at least 2.5 times as long as wide in *A. blitoides* f. *densifolius* (Thellung 1914: 292; and pers. obs.).

1. Leaf blade usually uniformly green, obovate to elliptic-spathulate, 1.5–2 times as long as wide, apex obtuse . . . . . ***Amaranthus blitoides*** var. ***blitoides***
– Leaf blade narrower, often white-speckled, oblong-lanceolate, at least 2.5 times as long as wide, apex acute . . . . . ***Amaranthus blitoides*** var. ***reverchonii***

3a. *Amaranthus blitoides* S. Watson var. ***blitoides***

Amaranthus blitoides [var. ***blitoides***] f. ***thellungii*** (Sennen ex Thell.) Raus, **stat. nov.** ≡ *Amaranthus blitoides* [unranked ("var. vel forma")] *thellungii* Sennen ex Thell. in Bol. Soc. Aragonesa Ci. Nat. 11: 240. 1912 ≡ *Amaranthus blitoides* var. *thellungii* (Sennen ex Thell.) Thell. in Ascherson & Graebner, Syn. Mitteleur. Fl. 5 (1. Abt.): 292. 1914. – Lectotype (designated by Mestre & al. 2021: 99): Europe, Spain, Catalonia, Barcelone, sables de la voie ferrée vers le Cimetière, 12 Nov 1911, *Sennen* (BC [Herb. Cadevall] BC822523).

Remarks — This taxon is recorded in all phytogeographic regions of Greece as defined in Dimopoulos & al. (2013: 22). In the Albanian distribution atlas by Vangjeli (2017: 121) *Amaranthus blitoides* is misleadingly illustrated with a mixed-up picture of *A. blitum* L.

3b. *Amaranthus blitoides* var. ***reverchonii*** Uline & W. L. Bray in Bot. Gaz. 19: 315. 1894. – Holotype: North America, U.S.A., Texas, Dallas, Oct 1881, *Reverchon 824* (US US00106236).

Amaranthus blitoides [var. ***reverchonii***] f. ***densifolius*** (Uline & W. L. Bray) Raus, **stat. nov.** ≡ *Amaranthus blitoides* var. *densifolius* Uline & W. L. Bray in Bot. Gaz. 19: 315. 1894. – Lectotype (designated by Bayón in Bayón & Freire 2011: 173): North America, U.S.A., Arizona, Hackberry, 18 Sep 1883, *Rusby 804* (NY NY00951459). Syntype: North America, U.S.A., Colorado, Pueblo Co., 10 Sep 1873, *Greene 614* (NDG NDG15477, verified by B. J. Hellenthal in sched. 14 Mar 2016).

Remarks — Revised material of the narrow-leaved variant has been seen from the Ionian island of Zakinthos, some of the Kyklades (Thira, Thirasia, Tinos), Kriti, the East Aegean islands (Chios, Kos, Rodos) and North Central Greece (Pella, Pieria). The seemingly limited distribution of *Amaranthus blitoides* var. *reverchonii* in Greece does not reflect a chorological or ecological focus but may be due to inobservant fieldwork and rather points to random introduction events in the past.

4. *Amaranthus blitum* L., Sp. Pl.: 990. 1753 ≡ *Albersia blitum* (L.) Kunth, Fl. Berol. 2: 144. 1838. – Lectotype (designated by Fillias & al. 1980: 150): Herb. Linn. No. 1117.14, right-hand plant (LINN).
= *Amaranthus lividus* L., Sp. Pl. 2: 990. 1753. – Lectotype (designated by Reveal & Jarvis 2009: 978): [icon] "*Blitum pulchrum rectum magnum rubrum*" in Bauhin & Cherler (1651: 966).
= *Amaranthus oleraceus* L., Sp. Pl., ed. 2: 1403. 1763 ≡ *Amaranthus blitum* var. *oleraceus* (L.) Hook. f., Fl. Brit. India 4: 721. 1885 ≡ *Amaranthus lividus* var. *oleraceus* (L.) Thell. ex Hayek in Repert. Spec. Nov. Regni Veg. Beih. 30(1): 162. 1924 ≡ *Amaranthus blitum* subsp. *oleraceus* (L.) Costea in Sida 19: 984. 2001. – Lectotype (designated by Fillias & al. 1980: 150): Herb. Linn. No. 1117.13 (LINN).
= *Amaranthus ascendens* Loisel., Not. Fl. France: 141. 1810 ≡ *Amaranthus blitum* var. *ascendens* (Loisel.) DC., Cat. Pl. Horti Monsp.: 4. 1813 ≡ *Amaranthus lividus* var. *ascendens* (Loisel.) Thell. ex Hayw. & Druce, Advent. Fl. Tweedside: 177. 1919. – Neotype (designated by Iamonico 2016a: 520): [icon] "*Blitum majus*" in Dodoens (1616: 617).
= *Amaranthus prostratus* Sadler, Fl. Comit. Pest 2: 354. 1826, nom. illeg. [non *Amaranthus prostratus* Bellardi ex Balb., Misc. Bot.: 44. 1804]. – Type: not designated.
= *Amaranthus commutatus* A. Kern. ex Hayek in Repert. Spec. Nov. Regni Veg. Beih. 30(1): 162. 1924. – **Lectotype (designated here):** Europe, Romania, in cultis et ruderatis circa oppidum Arad, *Simkovics*, Flora exsiccata austro-hungarica no. 1017 (B B 10 1075928).
– "*Amaranthus viridis*" sensu Halácsy (1904: 37); Rechinger (1944: 125) [non *Amaranthus viridis* L., Sp. Pl., ed. 2: 1405. 1763].

Remarks — The species is native to W, C and S Europe (Jalas & Suominen 1980: 97, map 634, under *Amaranthus lividus*), N and tropical Africa, and SW Asia (Bayón 2015: 309–310). In Greece it has been reported from nearly all phytogeographical regions except Northern Pindos and East Central as defined in Dimopoulos & al. (2013). It was introduced to North and South America, Australia, New Zealand and Japan and is widely cultivated in SW and E Asia as a vegetable crop, formerly likewise in Greece (βλίτα, see Heldreich 1862), gradually replaced by spinach (*Spinacia oleracea* L.) from the 20th century onward. Erect cultigens with robust stems and leaf blades up to 8 × 9 cm, treated by Linnaeus at specific rank, vary in overall colour from red (*A. lividus*) to green (*A. oleraceus*); *A. blitum* var. *oleraceus* is mentioned as formerly cultivated in Thrace (sensu Hayek 1924–1927, covering parts of Bulgaria, Greece and Turkey-in-Europe). Unfortunately, the name *A. viridis* has been misapplied to *A. blitum* in influential Greek floras (Halácsy 1904; Rechinger 1944), which makes previous floristic

records questionable unless cited specimens are revised. The combination *A. lividus* var. *ascendens* published in Hayek's *Prodromus florae peninsulae balcanicae* (Hayek 1924: 162) is a later isonym (which may be nomenclaturally disregarded, see *Shenzhen Code* Art. 6 Note 2).

Amaranthus commutatus was described from Hungary (Kerner 1875). The name represents a designation for a fictitious taxon (see below); Kerner's original collections, examined by Thellung (Thellung 1914: 326), turned out to clearly belong to *A. blitum* (corroborated by Beck 1909: 181). Based on Thellung's critical revision, *A. commutatus* was correctly published by Hayek as a synonym of *A. blitum* (1924: 162, under *A. lividus* var. *ascendens*), followed by Morariu (1952: 603). A widespread exsiccatum is selected here as the lectotype of *A. commutatus*. Later the name *A. commutatus* was consequently omitted in basic sources on vascular plants of Europe (see, e.g., Jalas & Suominen 1980; Greuter & al. 1984; Tutin & al. 1993), namely with respect to its terra typica Hungary (Soó 1970; Bartha & al. 2015). Its resurrection in recent Bulgarian floristics engenders that *A. blitum* is encountered twice in the Conspectus of the Bulgarian vascular flora, viz. under its synonyms *A. commutatus* (Assyov & al. 2012: 65) and *A. lividus* (Assyov & al. 2012: 66). A proposal to reject the name *A. blitum* in favour for *A. lividus* was declined by the Committee for Spermatophyta (Jarvis 2007).

5. *Amaranthus bouchonii* Thell. in Monde Pl. 27: 4. 1926 ≡ *Amaranthus hybridus* subsp. *bouchonii* (Thell.) O. Bolós & Vigo in Butl. Inst. Catalana Hist. Nat., Secc. Bot. 38: 89. 1974 ≡ *Amaranthus powellii* subsp. *bouchonii* (Thell.) Costea & Carretero in Sida 19: 964. 2001. – Lectotype (designated by Hügin 1987: 466, 473): Europe, France, Bordeaux, Allée du Boutaut, chemin remblaye avec des balayures du port, 25 Sep 1925, *Bouchon* (BAS; isolectotypes: US US106237 [fragment; see Iamonico 2016a: 521], Z Z000000239 [fragment]).

Remarks — Hügin's effective lectotypification of the name *Amaranthus bouchonii* (Hügin 1987: 466, 473) makes Iamonico's subsequent designation of the identical lectotype superfluous (Iamonico 2016a: 520). The type was definitely accepted as such by the prior typifying author, and the type element was clearly indicated by direct citation including the term "Typus (lecto)"; the phrase "designated here" (hic designatus) or an equivalent is mandatory only on or after 1 Jan 2001 (*Shenzhen Code* Art. 7.11.) but is literally published in Hügin (1987: 473, "als Lectotypus wird daher die Pflanze in Basel (BAS) gewählt [therefore the sheet kept in Basel (BAS) is chosen as the lectotype]"). Bouchon's original specimen is kept in BAS (Herbarium generale adventivum); a barcode will be available after completion of the digitization of the collection (currently under preparation, see https://herbarium.unibas.ch/de/sammlungen/digitalisierung/). Fragments in US and Z are annotated as duplicates by the monographer Thellung; no type material is found in Bouchon's personal herbarium at LA and P (see Hügin 1987).

Amaranthus bouchonii is considered of W European origin, presumably evolved in SW France by mutation in populations of the adventive alien *A. powellii* (Wilkin 1992; Costea & al. 2001a; Iamonico 2015b). It is established as a ruderal, agricultural and horticultural weed in W and C Europe (Hügin 1986, 1987; Iamonico 2015a). In Greece, it was first found in 1980 (Kriti, Geropotamos plain, Raus 1997; see Table 1), now met with elsewhere in Greece as an infrequent casual alien with naturalization status so far unknown (Arianoutsou & al. 2010), additionally published from the Aegean islands of Lesvos (Bazos & al. 2007: 206) and Thasos (Biel & Tan 2016: 432) and from Nomos Florina in NW Greece (Willing & Willing 2018: 57) but probably more widespread in the country. Specific rank is advisable because constancy of critical morphological and carpological characters in *A. bouchonii* was experimentally proven on plants cultivated for eight years in contact with *A. hybridus*, *A. powellii* and *A. retroflexus* (Costea & al. 2001a); in addition, Hügin (1986; 1987: 473) found specific discontinuities in germination of *A. bouchonii*, *A. powellii* and *A. retroflexus*. Subspecific rank under *A. hybridus* or *A. powellii*, as advocated by various authors, seems inappropriate because *A. bouchonii* is not known to occur in the North American native ranges of *A. hybridus* or *A. powellii* with a diverging distribution pattern; Mosyakin & Robertson (2003) signified the formal recognition of *A. bouchonii* in North American material as "premature".

6. *Amaranthus caudatus* L., Sp. Pl.: 990. 1753. – Lectotype (designated by Townsend 1974: 10): Herb. Linn. No. 1117.26 (LINN).

Remarks — Unknown in the wild state ("homeless cultigen"), this species probably evolved in Andean South America from its assumed wild progenitor *Amaranthus quitensis* (Thellung 1914: 233; Bayón 2015: 278), with which it shares obovate to spathulate perianth segments of the female flowers, distinctly obtuse at apex and with marked midrib continued into an apical mucro. *Amaranthus caudatus* is an economically important pseudocereal crop in N Argentina, Bolivia, Peru and Ecuador, after 1492 AD likewise produced in tropical to warm-temperate parts of the Old World. In Greece it is cultivated as a garden ornamental; occasional escapes from cultivation, found scattered as an ephemeral weed near places of cultivation, are not naturalized (Arianoutsou & al. 2010). The species is not listed for the Balkan countries adjacent to Greece (Iamonico 2015a), possibly because ornamental garden plants are, as a matter of principle, not covered by the relevant regional floras and checklists (Assyov & al. 2012; Barina & al. 2018; Micevski 1995). A single 19th century record was published from Turkey-in-Europe (Aellen 1967: 341), but recent collections or observations from there are lacking. Records of *A. cau-*

Table 1. *Amaranthaceae* at specific rank reported from Greece on an ascending time scale of first publication, or oldest voucher seen by the present author, and arranged in synoptic columns of major basic floras showing the stepwise floristic progress. Herbarium acronyms are according to Thiers (2022+).

Accepted name (*A.* = *Amaranthus*)	**First record in Greece** (specimen seen!)	**Smith (1816)** *Florae graecae prodromus*	**Boissier (1879)** *Flora orientalis*	**Halácsy (1902)** *Conspectus florae graecae*	**Hayek (1927)** *Prodromus florae peninsulae balcanicae*	**Rechinger (1944)** *Flora aegaea*	**Raus (1997)** *Flora hellenica*
A. graecizans	Sibthorp in **1790**s	*A. "blitum"* misapplied	*A. silvestris*	*A. "blitum"* misapplied	*A. angustifolius*	*A. silvester*	*A. graecizans*
Achyranthes sicula	Ehrenberg c. **1820**		*Achyranthes aspera* var. *argentea*			*Achyranthes aspera* var. *sicula*	*Achyranthes sicula*
A. retroflexus	Frivaldszky c. **1836**		*A. retroflexus*	*A. retroflexus*	*A. retroflexus*	*A. retroflexus*	*A. retroflexus*
A. blitum	Friedrichsthal c. **1838**		*Albersia blitum*	*A. "viridis"* misapplied	*A. lividus*	*A. "viridis"* misapplied	*A. blitum*
A. deflexus	Friedrichsthal c. **1838**		*Albersia deflexa*	*A. deflexus*	*A. deflexus*	*A. deflexus*	*A. deflexus*
A. hypochondriacus	Friedrichsthal c. **1838** (W!)						*A. hypochondriacus*
A. albus	Heldreich in **1850**s		*A. albus*	*A. albus*	*A. albus*	*A. albus*	*A. albus*
A. hybridus	Orphanides in **1850s**		*A. chlorostachys*	*A. chlorostachys*	*A. hybridus* var. *chlorostachys*	*A. chlorostachys*	*A. hybridus*
Polycnemum arvense	Haussknecht **1885**			*Polycnemum arvense*			
						Polycnemum in *Chenopodiaceae*	
Polycnemum majus	Sintenis **1889**			*Polycnemum majus*			
A. caudatus	Halácsy obs. in **1890s**			*A. caudatus*	*A. caudatus*		*A. caudatus*
A. cruentus	Heldreich **1891** (W!)					*A. paniculatus*	*A. cruentus*
A. viridis	Heldreich **1899** (WU-Hal!)						*A. viridis*
A. blitoides	Wilson & al. **1917** (BM!)						*A. blitoides*
A. muricatus	Snogerup & al. **1968** (LD!)						*A. muricatus*
A. quitensis	Hansen & al. **1971** (C!)						*A. quitensis*
A. powellii	Stamatiadou **1972** (ATH!)						*A. powellii*
A. spinosus	Strid & al. **1975** (C!)						*A. spinosus*
A. emarginatus	Raus **1989** (B!)						*A. emarginatus*
A. bouchonii	Hügin **1990** (B!)						*A. bouchonii*
A. watsonii	Willing **2003** (B!)						
A. palmeri	Raabe **2005** (B!)						

datus determined on the basis of Greuter & al. (1984: 46) are questionable unless corroborated by revised herbarium specimens; they may refer to *A. cruentus* or *A. quitensis*.

7. *Amaranthus commutatus* A. Kern. in Oesterr. Bot. Z. 25: 194. 1875.

Remarks — As already mentioned under *Amaranthus blitum* above, *A. commutatus* is a designation with no nomenclatural value, referring to a non-existent taxon. Its concept was investigated by the monographer Thellung on authentic material collected by Anton Kerner von Marilaun in Hungary and deposited in WU. Thellung (1914: 326) revealed the protologue as referring to a fictitious species, namely a taxonomic chimaera of *A. graecizans* ("*A. angustifolius silvester*" sensu Thellung) and *A. blitum* ("*A. lividus ascendens*" sensu Thellung). Kerner's original collections, seen by Thellung (1914: 326), turned out to undoubtedly represent *A. blitum*, and the character of irregularly rupturing fruits (not truly circumscissile), pointing toward *A. graecizans*, was identified by Thellung as an artefact due to improper plant pressing. The name *A. commutatus* A. Kern. ex Hayek (Hayek 1924: 162) is utilizable as a synonym of *A. blitum* (see above). However, there is no existing taxon behind "*A. commutatus* A. Kern." that would be available for any kind of typifying action. Iamonico (2020) arrived at the same conclusion, and his idea to substantiate the name *A. commutatus* as a "species incertae sedis" is not feasible because this would require an existing taxon behind it, which is not the case. The name *A. commutatus* was rightly not in use, after 1875, in subsequent basic sources on European vascular plants. Surprisingly, "*A. commutatus* A. Kern." survived and is currently preliminarily accepted in the Euro+Med PlantBase (Iamonico 2015a), confined to Bulgaria as "alien with unknown status", not native, although described from Hungary and recorded by distributed exsiccata from adjacent W Romania (Beck 1909: 181). In parallel, it is given as native to Australia (Govaerts 1995: 203), more precisely Queensland ("This species is accepted, and its native range is Australia. Native to: Queensland"; POWO 2022). Iamonico (2020: 193) conjectured the similarity of the Australian *A. rhombeus* R. Br. (3-tepaled flower, circumscissile fruit) as the reason for this but at the same time excluded *A. commutatus* as a possible synonym of *A. rhombeus*. The critical Australian Plant Name Index (Chapman 1991) does not at all include or synonymize the name "*A. commutatus*". In short, it is a rare oddity in botanical literature: monographers and compilers of online checklists and atlases argue on the internet about the imaginary native range of an imaginary taxon!

8. *Amaranthus crispus* (Lesp. & Théveneau) A. Braun ex J. M. Coult. & S. Watson in Gray, Manual, ed. 6: 428. Jan–Mar 1890 ≡ *Euxolus crispus* Lesp. & Théveneau in Bull. Soc. Bot. France 6: 656. 1859 ≡ *Albersia crispa* (Lesp. & Théveneau) Asch. ex Hausskn. in Ber. Deutsch. Bot. Ges. 8: (121). 1890. – Lectotype (designated by Iamonico 2016a: 527): Europe, France, Lavoire a laine de Bessan, 12 Oct 1858, *Théveneau* (P P00572004, plant on the left).

= *Amaranthus crispus* N. Terracc. in Rendiconti Reale Accad. Sci. Fis., ser. 2, 4: 188. 1890 & in Atti Reale Accad. Sci. Fis., ser. 2, 4(2): 7. Jul 1890, nom. illeg. – Lectotype (designated by Iamonico 2016a: 521): Europe, Italy, Lazio, Frosinone, ad vias in submontosis Campaniae fontanaliri, Sep 1821, *Terracciano* (FI).

Remarks — *Amaranthus crispus* resembles *A. blitoides* with respect to the usually prostrate habit, axillary flower clusters and the number of perianth segments, (4 or)5, but differs on its undulate-crenate leaves and indehiscent, muricate fruits. Native to Argentina, Chile and Uruguay (Pedersen 1999: 23; Bayón 2015: 321), this casual alien has been known to occur in the Vardar valley of North Macedonia since 1958 (Micevski 1995: 404) and in the Strumitza valley of SW Bulgaria (Assyov & al. 2012: 65). From both areas it can be expected to invade suitable habitats along the rivers Axios and Strymonas in N Greece (Raus 1997: 144). The species holds the 61st rank among the 150 most widespread alien plant species in Europe (Lambdon & al. 2008) but has not settled in Greek localities so far. The nomenclatural authorship given by Aellen (1959: 491) with N. Terracciano as combining author of the name *A. crispus* is incorrect but widely used in subsequent basic floras and checklists covering Balkan countries (Aellen 1964; Greuter & al. 1984; Akeroyd 1993; Micevski 1995; Strid & Tan 1997; Assyov & al. 2012). As already pointed out by Fiori (1896), Terracciano (1890a, 1890b) intended to describe a species endemic to Italy and at the same time new to science, not being aware of the nomenclaturally competing *Euxolus crispus* of 31 years earlier (Lespinasse & Théveneau 1859). Therefore, *A. crispus* N. Terracc. was from the start both a later homonym and a heterotypic synonym of *A. crispus* (Lesp. & Théveneau) A. Braun ex J. M. Coult. & S. Watson (for details, see Iamonico 2016a: 521–522). There is much uncertainty in herbaria and printed sources regarding the authors of the basionym of the latter, with "*Euxolus crispus* Lessing & Thévenau" one example distributed by the research and teaching platform JSTOR (2022). However, the German botanist Christian Friedrich Lessing, grandson of the poet Gotthold Ephraim Lessing, was settled far away in Krasnojarsk (Siberia) when his French colleagues published the protologue of *Euxolus crispus*, and Lespinasse's co-author is correctly spelled Théveneau.

9. *Amaranthus cruentus* L., Syst. Nat., ed. 10: 1269. 1759 ≡ *Amaranthus hybridus* subsp. *cruentus* (L.) Thell. in Mém. Soc. Natl. Sci. Nat. Math. Cherbourg 38: 205. 1912. – Lectotype (designated by Townsend 1974: 12): Herb. Linn. No. 1117.25 (LINN).

= *Amaranthus flavus* L., Syst. Nat., ed. 10: 1269. 1759. – Lectotype (designated by Iamonico 2014b: 147): Herb. Linn. No. 1117.23 (LINN).
= *Amaranthus paniculatus* L., Sp. Pl., ed. 2: 1406. 1763. – Lectotype (designated by El Hadidi & El Hadidy 1981: 37): Herb. Linn. No. 1117.20 (LINN).
= *Amaranthus sanguineus* L., Sp. Pl., ed. 2: 1407. 1763. – Lectotype (designated by Iamonico 2014b: 148): Herb. Linn. No. 1117.21 (LINN).

Remarks — The species most likely evolved in Central America (Mexico, Guatemala) by domestication from *Amaranthus hybridus*. It is cultivated as a pseudocereal (grain amaranth) in tropical to warm-temperate regions of both hemispheres (Bayón 2015: 279). Produced commercially in hot and dry areas of the United States, Argentina and China, its quick growth and high nutritional value (with a much higher protein content than in most other cereals) make it an ideal crop for developing countries (Ventosa-Febles 2015). It is also a traditional leaf vegetable in countries of tropical Africa and S and SE Asia (Costea & al. 2003). In Greece it is a popular pot herb and garden vegetable, occasionally escaping from cultivation and scattered all over Greece (Strid & Tan 1997: map 258) but not truly naturalized (Arianoutsou & al. 2010). Some cultigens with differently coloured inflorescences were formerly described as separate species (*A. flavus*, *A. sanguineus*). *Amaranthus cruentus* can be confused with some forms of *A. hypochondriacus* but differs in the constantly shorter floral bracts and the slender, usually patent lateral inflorescence branches (not thick and stiffly ascending-erect as in *A. hypochondriacus*). The species is given for Albania as a casual alien (Barina & al. 2018) but has not been mentioned so far for North Macedonia (Iamonico 2015a). In Bulgaria it is considered naturalized (Greuter & al. 1984; Iamonico 2015a) but was not listed or mapped in Assyov & al. (2012), perhaps due to the taxonomically and floristically misleading inclusion in *A. hybridus* (as, unfortunately, advocated by Greuter & al. 1984).

10. *Amaranthus deflexus* L., Mant. Pl. Alt.: 295. 1771 ≡ *Euxolus deflexus* (L.) Raf., Fl. Tellur. 3: 42. 1837 ≡ *Albersia deflexa* (L.) Fourr. in Ann. Soc. Linn. Lyon, sér. 2, 17: 142. 1869. – Lectotype (designated by Aellen 1972: 7): Herb. Linn. No. 1117.18 (LINN).
= *Amaranthus scandens* L. f., Suppl. Pl.: 419. 1782. – Type: not designated.
= *Amaranthus prostratus* Bellardi ex Balb., Misc. Bot.: 44. 1804. – Lectotype (designated by Iamonico 2016a: 527): [icon] "*Amaranthus prostratus*" in Balbis in Misc. Bot.: t. 10. 1804 [copper engraving taken from Balbis in Mem. Acad. Sci. Turin 7(1): 368. 1804].

Remarks — A short-lived perennial with a tap root, *Amaranthus deflexus* is native to temperate South America (Argentina, Bolivia, Chile, Peru, Uruguay); it is introduced as a ruderal weed in North America, Europe, SW Asia, N and S Africa, Korea, Japan, Tasmania and New Zealand (Pedersen 1999: 23; Bayón 2015: 324; POWO 2022). Established in the Mediterranean area since the early 19th century, it was first mentioned from Greece (North East, Kavala) under its synonym *A. prostratus* (Grisebach 1846); it now occurs countrywide (Strid & Tan 1997: map 270) and is considered fully naturalized (Arianoutsou & al. 2010). The same is true for adjacent countries N of Greece (Iamonico 2015a).

11. *Amaranthus emarginatus* Salzm. ex Uline & W. L. Bray in Bot. Gaz. 19: 319. 1894 ≡ *Euxolus viridis* var. *polygonoides* Moq. in Candolle, Prodr. 13(2): 274. 1849 ≡ *Amaranthus ascendens* var. *polygonoides* (Moq.) Thell. in Mém. Soc. Natl. Sci. Nat. Math. Cherbourg 38: 215. 1912 ≡ *Amaranthus lividus* subsp. *polygonoides* (Moq.) Thell. ex Probst, Wolladventivfl. Mitteleur.: 74. 1949 ≡ *Amaranthus blitum* subsp. *polygonoides* (Moq.) Carretero in Anales Jard. Bot. Madrid 41: 276. 1985. – Lectotype (designated by Hügin 1987: 461): Asia, Indonesia, Java, 1842–1844, *Zollinger 1646* (P P00572006, plant on the left; isolectotypes: G G00098622, G GDC00138473, P P00572007).
– "*Amarantus polygonoides* Zolling." Moquin-Tandon in Candolle, Prodr. 13(2): 274. 1849, nom. inval., pro syn.
– "*A[marantus]. emarginatus* Salzm." Moquin-Tandon in Candolle, Prodr. 13(2): 274. 1849, nom. inval., pro syn.

Remarks — Despite the differing epithets, *Amaranthus emarginatus* and *Euxolus viridis* var. *polygonoides* are homotypic (see Hügin 1987: 461; Bayón 2015: 310; POWO 2022). When Moquin-Tandon (1849: 274) validly published the name *E. viridis* var. *polygonoides*, he cited in synonymy "*A. emarginatus* Salzm.", an unpublished collector's name for plants that Philipp Salzmann had collected in Brazil in 1830 (see Röse 1853). Forty-five years later, Uline & Bray (1894: 319) used this binomial as a replacement name when they raised Moquin-Tandon's taxon to specific rank, because the name *A. polygonoides* had already been published by Linnaeus for a different, Caribbean amaranth (Linnaeus 1759: 27; Iamonico 2011; POWO 2022). The type of *A. emarginatus* is therefore the same as that of *E. viridis* var. *polygonoides* (*Shenzhen Code* Art. 7.4). Hügin (l.c.) chose the specimen *Zollinger 1646* in Paris (P00572006) as the lectotype because it was at Moquin-Tandon's hand in the description of *E. viridis* var. *polygonoides* according to the pertinent handwritten herbarium label. The lectotype is the plant on the left, collected by Zollinger, who had wrongly assumed that it was probably *A. polygonoides* L.; the plant on the right was collected in Brazil by Salzmann (Hügin l.c.). The attempted second-step lectotypification by Bayón (l.c.), who chose the duplicate specimen

of *Zollinger 1646* in Paris (P00572007), is ineffective (*Shenzhen Code* Art. 9.19) because it was already clear which of the two specimens in Paris was designated as the lectotype by Hügin (l.c.).

The species is native to the tropics of both hemispheres (Thellung 1914: 320; Hügin 1987: 461; Bayón 2015: 310, 2020: 51) and is introduced to warm-temperate parts of North America, Europe and N Africa (Townsend 1985: 35; Iamonico 2015a). *Amaranthus emarginatus* was sometimes merged with *A. blitum* L. and ranked as a subspecies or variety of the latter (Townsend 1985: 35, "after some vacillation"; Carretero 1990; Lambinon & Rastetter 1993; Bayón 2015, 2020). The two taxa are however of disparate origin: *A. emarginatus* pantropical vs *A. blitum* Old-World Mediterranean; they are reasonably treated as separate species in order to reflect their different chorology and evolutionary history (Iamonico 2016a).

On the basis of growth form, leaf size and inflorescence arrangement, two infraspecific taxa of *Amaranthus emarginatus* can be distinguished in Greece. They occupy clearly different ecological niches related to the capability to endure water stress, such as temporary inundation, which led Loos (2010) to accept them as distinct species, while Iamonico (2015b) treated them at varietal rank, following Lambinon & Worms (1993). In Greece they behave as ecologically disjunct subspecies, in taxonomic accordance with Hügin (1987) and Raus (1997).

1. Plant prostrate, usually appressed to surface of substrate; leaves (1.0–)2.0–3.0 × (0.5–)1.0–1.5 cm; inflorescence predominantly in axillary glomerules, terminal spike if present short and thick, up to 2.0 cm long . . . ***Amaranthus emarginatus*** subsp. ***emarginatus***
– Plant ascending, mature stems sometimes overhanging; leaves (2.0–)3.0–4.0(–4.5) × (1.2–)1.5–2.5 cm; inflorescence predominantly in long and slender, usually thin and flexuous axillary and terminal spikes 7.5–12.0 cm long . . . . . ***Amaranthus emarginatus*** subsp. ***pseudogracilis***

11a. ***Amaranthus emarginatus*** Salzm. ex Uline & W. L. Bray subsp. ***emarginatus*** ≡ *Amaranthus blitum* subsp. *emarginatus* (Salzm. ex Uline & W. L. Bray) Carretero & al. in Anales Jard. Bot. Madrid 44: 599. 1987 ≡ *Amaranthus blitum* var. *emarginatus* (Salzm. ex Uline & Bray) Lambinon in Bull. Soc. Échange Pl. Vasc. Eur. Occid. Médit. 24: 55. 1993 ≡ *Amaranthus emarginatus* Salzm. ex Uline & W. L. Bray var. *emarginatus* (sec. Iamonico in Phytotaxa 199: 31. 2015).

Remarks — This subspecies is native to the tropics of both hemispheres, locally introduced to warm-temperate parts of Europe and North America (Bayón 2020: 51). In Greece it is a fully established element of annual pioneer vegetation on muddy ground of autumnally dried-up rivers and lakes (abundantly so in North East, Lake Kerkini), annually resprouting from the local seedbank; it is expected to colonize frequently irrigated garden land as well. The prostrate, mat-forming growth is not caused by environmental factors but is genetically fixed according to Hügin (1987). Decumbent forms of *Amaranthus blitum*, referred to as *A. blitum* f. *microphyllus* (Opiz) Thell. or *A. blitum* f. *repens* (Spenner) Thell., differ clearly in their constantly larger fruits and seeds and usually variously speckled, somewhat fleshy leaves (Thellung 1914: 328–329; Hügin 1987: 458–460).

11b. ***Amaranthus emarginatus*** subsp. ***pseudogracilis*** (Thell.) Hügin in Willdenowia 16: 463. 1987 ≡ *Amaranthus lividus* subvar. *pseudogracilis* Thell. in Ascherson & Graebner, Syn. Mitteleur. Fl. 5 (1. Abt.): 321. 1914 ≡ *Amaranthus blitum* var. *pseudogracilis* (Thell.) Lambinon in Bull. Soc. Échange Pl. Vasc. Eur. Occid. Médit. 24: 55. 1993 ≡ *Amaranthus pseudogracilis* (Thell.) G. H. Loos in Online-Veröff. Bochumer Bot. Ver. 2: 4. 2010 ≡ *Amaranthus blitum* subsp. *pseudogracilis* (Thell.) N. Bayón in Ann. Missouri Bot. Gard. 101: 312. 2015 ≡ *Amaranthus emarginatus* var. *pseudogracilis* (Thell.) Iamonico in Pl. Biosyst. 150: 532. 2016. – Holotype (identified by S. Bernhard & R. Vogt, 12 Feb 2020, in sched., superseding the lectotype designated by Iamonico 2016a: 523): Europe, Germany, Elsass-Lothringen, im Botanischen Garten Straßburg, 8 Aug 1904, *Ludwig 12130* (B B100261513).

Remarks — This is a pantropical element, introduced to North America and Europe (Bayón 2015: 312, 2020: 51). The subspecies is a casual alien of irrigated gardens and vegetable fields (of melons, cucurbits etc.) as well as moist ruderal places in Greece, with a status of naturalization unknown so far (Raus & Svensson 2017). Recently found as common in Chalandri, a suburban area of Athens (Polymenakos & Tan 2016), it is certainly undercollected, and the actual distribution may be much wider than the present data indicate. The epithet *pseudogracilis* refers to the usually well-developed lateral and terminal, spike-like inflorescences, which resemble those of *Amaranthus viridis* L. The latter species was traditionally treated under its unresolved synonym *A. gracilis* in previous floristic sources (Iamonico 2016b) but clearly differs on its apically obtuse, not or scarcely emarginate leaves and strongly wrinkled fruits. It should be noted that Iamonico (2016a: 523) allocated a wrong type locality ("Mecklenburg-Vorpommern, Strasburg") to the lectotype, designated by him, of *A. emarginatus* var. *pseudogracilis*, induced by Costea & al. (2001b: 981), who unfortunately copied the type locality from the label of the holotype in B with the incomplete spelling "Strasburg" (instead of Straßburg); the mistake was further distributed in literature (Iamonico 2015b: 32; Bayón 2015: 312, 2020: 51). The collector of the type material, the German botanist Alfred Ludwig (see Schumacher 1967), lived and collected from 1899 to

1906 in Straßburg (Strassburg) im Elsass (what is today Strasbourg, Bas-Rhin, France) but not in Strasburg in der Uckermark (Mecklenburg-Vorpommern, Germany) where a Botanic Garden was never situated.

12. *Amaranthus graecizans* L., Sp. Pl.: 990. 1753 ≡ *Amaranthus angustifolius* Lam., Encycl. 1: 115. 1783, nom. illeg. ≡ *Amaranthus blitum* var. *graecizans* (L.) Moq. in Candolle, Prodr. 13(2): 263. 1849 ≡ *Amaranthus angustifolius* var. *graecizans* (L.) Thell. in Ascherson & Graebner, Syn. Mitteleur. Fl. 5 (1. Abt.): 306. 1914. – Lectotype (designated by Fernald 1945: 139): North America, U.S.A., Virginia, Herb. Clayton no. 442 (BM BM000051563). – Note: Fernald's type choice appears to be the earliest, although many subsequent authors have followed Dandy & Melderis in Fernandes (1957: 191) in accepting the specimen Herb. Linn. No. 1117.3 (LINN) as the type (Jarvis 2007: 283).

– "*Amaranthus blitum*" sensu Smith (1809: 235); Halácsy (1904: 36) [non *Amaranthus blitum* L., Sp. Pl.: 990. 1753].

Remarks — *Amaranthus graecizans* is native to the Mediterranean basin and beyond, extending to tropical Africa, India, C Asia and C Europe (Jalas & Suominen 1980: 96–97; Bayón 2015: 330); it is scattered all over Greece (Strid & Tan 1997: map 267) and in adjacent countries (Iamonico 2015a). The species is sometimes similar in habit to and therefore confused with *A. blitoides* but is always distinguished on the 3 perianth segments, which usually become papery at maturity (vs 4 or 5 in *A. blitoides*, which tend to become cartilaginous). Confusion of the two taxa is demonstrated, for instance, in selected Albanian sources (see Raus 2018): *A. graecizans* is incorrectly keyed-out in the group of taxa with more than 3 perianth segments in an excursion flora (Vangjeli 2015); and it is erroneously illustrated with a picture of typical *A. blitoides* with white-margined leaves in a distribution atlas (Vangjeli 2017: 123). Unfortunately, the name *A. blitum* has been misapplied to *A. graecizans* in some basic Greek floras (Smith 1809; Halácsy 1904), which makes previous floristic records questionable unless specimens are revised. In its native Old-World range, *A. graecizans* varies with respect to leaf, bract, perianth and fruit characters; four subspecies are currently geographically defined (though rather weakly so), two of them restricted to Africa and Asia (Bayón 2015). Subspecific rank, however, seems overrated because the taxa do not exhibit either satisfactory chorological discreteness or are otherwise based on inconstant carpological characters of little taxonomic value (Thellung 1914: 310–311); hence Aellen (1967; 1972), Raus (1997) and Stace (2010) advocated varietal rank. To achieve accordance with the Euro+Med PlantBase (Iamonico 2015a) and Flora of Cyprus (Hand & al. 2011+), Greek material is allocated here to the two accepted subspecies confined to Europe, namely subsp. *graecizans* and subsp. *silvestris*.

1. Leaf blade lanceolate, (2.0–)3.0–5.0(–6.0) × 0.5–1.5 cm, c. 3.0–6.0 times as long as wide . . . . . ***Amaranthus graecizans*** subsp. ***graecizans***
– Leaf blade rhombic-ovate, 5.0–6.0 × 2.5–3.0 (–3.5) cm, c. 1.8–2.2 times as long as wide . . . . . ***Amaranthus graecizans*** subsp. ***silvestris***

12a. *Amaranthus graecizans* L. subsp. ***graecizans*** ≡ *Amaranthus graecizans* L. var. *graecizans* (sec. Aellen in Davis, Fl. Turkey East Aeg. Isl. 2: 343. 1967).

Remarks — The narrow-leaved, nominate subspecies is said to be dominant in the warmer parts of SW Asia (Townsend 1985) and is accordingly encountered in the Aegean coastal area of Anatolia (Aellen 1967). In Attiki and on some of the Kyklades it is found growing sympatrically with *Amaranthus graecizans* subsp. *silvestris*; its limited distribution in Greece does not appear ecology-based but may merely reflect random introduction events in the past. The species name *A. angustifolius* Lam., alluding to the key character, is illegitimate because the earlier, legitimate species name *A. graecizans* L. was cited in synonymy.

12b. *Amaranthus graecizans* subsp. ***silvestris*** (Vill.) Brenan in Watsonia 4: 237. 1961 ≡ *Amaranthus silvestris* Vill, Cat. Jard. Pl. Strasbourg: 111. 1807 ≡ *Amaranthus graecizans* var. *silvestris* (Vill.) Asch. in Schweinfurth, Beitr. Fl. Aethiop.: 176. 1867 ≡ *Amaranthus angustifolius* var. *silvestris* (Vill.) Thell. in Schinz & Keller, Fl. Schweiz, ed. 4, 1: 222. 1923. – Lectotype (designated by Townsend 1985: 31): Europe, France, locality unstated, Herb. Tournefort No. 1849 (P P00420078).

Remarks — This subspecies is the commonest form of *Amaranthus graecizans* in Europe (Townsend 1985), also reported from Albania, Bulgaria, Greece (all regions), North Macedonia and Turkey-in-Europe (Iamonico 2015a). It is introduced as an agricultural weed and ruderal alien to other parts of the world, e.g. NE North America (U.S.A.: New Jersey, see Mosyakin & Robertson 2003: 434) and Australia (Queensland, South Australia, Victoria, see Palmer 2009: 116). It was formerly cultivated as a vegetable crop in Greece (βλίτα, see Heldreich 1862).

13. *Amaranthus hybridus* L., Sp. Pl.: 990. 1753. – Lectotype (designated by Townsend 1974: 19): Herb. Linn. No. 1117.19 (LINN).

= *Amaranthus chlorostachys* Willd., Hist. Amaranth.: 34. 1790. – Lectotype (designated by Iamonico 2016a: 521): origin unstated, *Hermes* (B B -W 17521 -01 0).

= *Amaranthus patulus* Bertol., Comment. Itin. Neapol.: 19. 1837 ≡ *Amaranthus retroflexus* subsp. *patulus* (Bertol.) Bonnier & Layens, Tabl. Syn. Pl. Vasc. France: 265. 1894 ≡ *Amaranthus hybridus* subsp. *patulus* (Bertol.) Carretero in Collect. Bot. 11: 127.

1979. – Lectotype (designated by Iamonico 2016a: 525): Europe, Italy, Campania, Napoli al Pasconcello, Sep 1834, *Bertoloni* (BOLO).
– "*Amaranthus cruentus*" sensu Greuter & al. (1984: 46), pro parte [non *Amaranthus cruentus* L., Syst. Nat., ed. 10: 1269. 1759].
– "*Amaranthus hypochondriacus*" sensu Greuter & al. (1984: 47), pro parte [non *Amaranthus hypochondriacus* L., Sp. Pl.: 991. 1753].

Remarks — *Amaranthus hybridus* is native to temperate North America and C and N South America and is introduced as a segetal and ruderal weed in warm-temperate regions worldwide (Bayón 2015: 285). It is recorded in all parts of Greece, where it is considered naturalized (Arianoutsou & al. 2010). The distribution map in Strid & Tan (1997: map 259) is rather outdated by recent fieldwork (see, e.g., Willing & Willing 2006: 38). In Mediterranean basic floristic literature, the name *A. hybridus* has repeatedly been misapplied to *A. powellii*, the related weedy amaranth with longer floral bracts (2.3–3.7 times as long as perianth vs 1.3–1.5(–2.0) times longer in *A. hybridus*) and stiffly erect, compact inflorescence branches (vs slender, ± patent ones in *A. hybridus*). It is also similar to *A. quitensis* but all perianth segments are acute (never spathulate and apically obtuse as in *A. quitensis*) and the inflorescence is green (not pale brownish green and without protuberant, membranous perianths in the male flowers as in *A. quitensis*). Literature records of *A. cruentus* and *A. hypochondriacus* based on the taxonomy adopted by Greuter & al. (1984: 46, 47) may largely refer to *A. hybridus* and need to be verified by revised herbarium specimens. Rejection of the name *A. hybridus* L. as ambiguous (in favour of *A. patulus* Bertol.; see Hügin 1987) is not advisable because it is clearly typified (Brenan 1961; Sauer 1967; Townsend 1974) and has been used in the correct sense in recent basic floras.

14. ***Amaranthus hypochondriacus*** L., Sp. Pl.: 991. 1753 ≡ *Amaranthus hybridus* subsp. *hypochondriacus* (L.) Thell. in Mém. Soc. Natl. Sci. Nat. Math. Cherbourg 38: 204. 1912. – Lectotype (designated by Townsend 1985: 25): Herb. Linn. No. 1117.24 (LINN).

Remarks — This species evolved by domestication in SW North America within the native range of its presumed wild progenitor *Amaranthus powellii*. It is widely cultivated as an ornamental plant, pseudocereal and fodder crop in tropical to warm-temperate regions worldwide (Bayón 2015: 289). In most parts of continental and insular Greece it is observed as a casual escape near its places of cultivation; although it was given as naturalized by Arianoutsou & al. (2010), there is no reliable evidence for this. It is also known to occur in Albania (Pils 2016: 21, P11) and Bulgaria (Assyov & al. 2012: 66). Records taken from floristic literature with determinations based on the taxonomic concept of Greuter & al. (1984: 47) are considered doubtful unless corroborated by revised herbarium specimens, in order to exclude confusion with *A. cruentus*, *A. hybridus*, *A. powellii* or *A. quitensis*. Rejection of the name *A. hybridus* as ambiguous in favour of *A. hypochondriacus* (Greuter 1981; Greuter & al. 1984) is not advisable because both names are clearly typified (Townsend 1974; 1985) and have been used in the correct sense in recent basic floras and monographs (Raus 1997; Bayón 2015; Iamonico 2015a, 2015b).

15. ***Amaranthus muricatus*** (Gillies ex Moq.) Hieron. in Bol. Acad. Nac. Ci. 4: 421. 1882 ≡ *Euxolus muricatus* Gillies ex Moq. in Candolle, Prodr. 13(2): 276. 1849. – Lectotype (designated by Iamonico 2016a: 529): South America, Argentina, Mendoza, *Gillies* (K K000195064, lower plant on sheet).

Remarks — *Amaranthus muricatus* is a perennial with a stout rootstock native to Bolivia, N Argentina, Paraguay and Uruguay (Pedersen 1999: 24); it is an invasive species in Africa, S Europe and Australia and to a lesser degree in North America and Asia (Mosyakin & Robertson 2003: 431; Bayón 2015: 341, 2020: 58), doing well in arid climates. It is naturalized in Greece (Arianoutsou & al. 2010), preferring secondary, stony habitats such as crevices of walls, and has been established on Syros (C Kyklades) since 1968. On the Greek mainland it was first recorded in 1999 from urban areas of Thessaloniki (Krigas & al. 1999) and is rapidly spreading there (Krigas & Kokkini 2004). The first record from the East Aegean Islands (Kalymnos) was in 2008 (Zervou & al. 2009) and from Attiki near Athens in 2016 (Polymenakos & Tan 2016). The species has not been reported so far from countries N of the Greek border, but it is known as an established alien in the W Mediterranean basin from Italy W to Morocco (Iamonico 2015a).

16. ***Amaranthus palmeri*** S. Watson in Proc. Amer. Acad. Arts. 12: 274. 1877. – Lectotype (designated by Sauer 1955: 31): North America, U.S.A., Texas, in rupibus Rio Grande, Jul 1834, *Berlandier 2407* (GH GH00037007).

Remarks — *Amaranthus palmeri* is native to SW North America, in the U.S.A. (S California to Texas) and N Mexico (Sauer 1955), and is a successful, invasive species recently spreading in warm-temperate parts of the Old World (Bayón 2020; Mennan & al. 2021). It has been known to occur as an agricultural and horticultural weed in Greece, with male and female plants, since 2005 (Raus & Raabe 2006), possibly starting from citrus orchards, and is meanwhile fully established in Peloponnisos around Mystras and Sparti. It is also recorded from larger islands, viz. Evvia (Willing & Willing 2006: 39–40) and Kriti (Gregor & Meierott 2013: 277). It is not yet known from neighbouring Balkan countries (Iamonico 2015a) but is a recent invader to Anatolia, first found with both sexes in cornfields along the İzmir–Çanakkale main road

in 2015 (Eren & al. 2016), and is expected to become one of the most economically troublesome weed species in Turkey in the coming years (Mennan & al. 2021). A similar scenario is predicted for Italy (Milani & al. 2021), owing to various herbicide resistances that have recently evolved in the species.

17. *Amaranthus powellii* S. Watson in Proc. Amer. Acad. Arts 10: 347. 1875 ≡ *Amaranthus retroflexus* var. *powellii* (S. Watson) B. Boivin in Naturaliste Canad. 93: 641. 1966 ≡ *Amaranthus hypochondriacus* var. *powellii* (S. Watson) Pedersen in Monogr. Syst. Bot. Missouri Bot. Gard. 74: 24. 1999 ≡ *Amaranthus hybridus* subsp. *powellii* (S. Watson) Karlsson in Nordic J. Bot. 20: 519. 2001. – Lectotype (designated by Iamonico 2016a: 525): North America, U.S.A., Arizona, "from Powell's Arizona seeds", 1874, *Powell* (US US00106256).

– "*Amaranthus chlorostachys*" auct. [non *Amaranthus chlorostachys* Willd., Hist. Amaranth.: 34. 1790].
– "*Amaranthus hybridus*" sensu Tutin & al. (1964: 109) [non *Amaranthus hybridus* L., Sp. Pl.: 990. 1753].
– *"Amaranthus hypochondriacus*" sensu Greuter & al. (1984: 47), pro parte [non *Amaranthus hypochondriacus* L., Sp. Pl.: 991. 1753].

Remarks — Native to SW North America, in the U.S.A. and adjacent regions of Mexico, this species is introduced as a segetal and ruderal weed in warm-temperate regions worldwide (Bayón 2015: 291). It is at least locally naturalized in Greece, according to Arianoutsou & al. (2010). Considered the putative wild progenitor of its domesticated descendant *Amaranthus hypochondriacus*, *A. powellii* has been reported from North and South Pindos, Peloponnisos, Sterea Ellas, North Central, North East and from the Aegean islands of Amorgos, Evvia, Karpathos, Kriti and Samothraki, but the actual distribution may be wider than the present data indicate. That the name *A. powellii* (and the taxon behind it) does not appear in the Euro+Med PlantBase for Albania, North Macedonia, Bulgaria and Turkey-in-Europe (Iamonico 2015a) is certainly due to its misleading synonymization with *A. hybridus* (Tutin & al. 1964) or *A. hypochondriacus* (Greuter & al. 1984). The name *A. hybridus* has been repeatedly misapplied to *A. powellii* in Mediterranean basic floras; *A. hybridus*, however, is generally distinguished by its usually slender, ± patent lateral branches of the inflorescence (vs compact and stiffly erect in *A. powellii*).

18. *Amaranthus quitensis* Kunth in Humboldt & al., Nov. Gen. Sp. 2, ed. folio: 156; ed. quarto: 194. 1818 ≡ *Amaranthus hybridus* var. *quitensis* (Kunth) Covas in Darwiniana 5: 336. 1941 ≡ *Amaranthus retroflexus* subsp. *quitensis* (Kunth) O. Bolòs & Vigo in Butl. Inst. Catalana Hist. Nat., Secc. Bot. 38: 89. 1974 ≡ *Amaranthus hybridus* subsp. *quitensis* (Kunth) Costea & Carretero in Sida 19: 955. 2001. – Holotype: South America, Ecuador, in ripa fluvii Guallabambae, alt. 1030 hex. [= 1850 m] (Regno Quitensi), Jun 1802, *Humboldt & Bonpland 3082* (P P00136030).

– "*Amaranthus caudatus*" sensu Greuter & al. (1984: 46), pro parte [non *Amaranthus caudatus* L., Sp. Pl.: 990. 1753].

Remarks — This species is native to subtropical and temperate South America, from Ecuador and S Brazil to S Argentina (Patagonia); it is introduced as a casual weed in Canada and in parts of W, C and N Europe (Hügin 1986, 1987; Karlsson 2001; Hand & al. 2022), where it is mostly ephemeral due to lack of frost resistance. *Amaranthus quitensis* is a river-bank pioneer in its native range and the supposed wild ancestor of *A. caudatus*. It is naturalized in the Azores and Balearic Islands (Bayón 2015: 286) and in Greece (Raus 1997; Iamonico 2015a); localities of collected specimens are known from all over Greece except the North Aegean islands. The flowering and fruiting period of *A. quitensis* extends to about seven months in Greece, from early summer to late autumn, which may be one reason for its rapid spread and naturalization (Arianoutsou & al. 2010). The species is clearly distant and chiefly distinguished from *A. hybridus* by the obovate to narrowly spathulate, apically obtuse inner perianth segments of the female flowers and by the usually numerous patent, pale brownish green, often sausage-shaped, apically obtuse lateral inflorescence branches, a diagnostic feature that is explicitly corroborated by Karlsson (2001: 60, fig. 25). A photograph in Vangjeli (2017: 120, under *A. hybridus*) shows exactly these characters and may be interpreted as the first record of *A. quitensis* for Albania. In *A. hybridus*, on the contrary, all perianth segments are acute or acuminate, and the lateral inflorescence branches are erecto-patent and thinning toward the apex. More similar is *A. retroflexus* on the basis of its obtuse to truncate-emarginate perianth segments of the female flowers, but that species differs in its markedly pubescent stem indumentum and few, erect, stout, usually pale to silvery green inflorescence branches usually appressed to the main axis (not brownish green and horizontally patent as in *A. quitensis*). The two taxa are likewise appropriately treated as separate species in accordance with Aellen (1959), Hügin (1987), Raus (1997), Karlsson (2001) and Iamonico (2015a). Unfortunately, *A. quitensis* fell into early oblivion, only c. 30 years after its publication as a species new to science, when Moquin-Tandon (1849: 265) categorized it as an insufficiently known taxon ("species non satis nota") by misjudgement of its bract characters ("calyce bracteis duplo longiore" instead of "bracteis subulatis, calyce duplo longioribus" as correctly stated in the protologue by Kunth in Humboldt & al. 1818). This is the reason why *A. quitensis* is not treated in any of the classical basic floras covering Greece (see Table 1) and adjacent countries (Iamonico 2015a). Its rehabilitation as an accepted species happened only in the early 20th century (Zobel 1909; Höck 1910; Thellung 1912; Zimmermann 1913) on the basis of correctly deter-

mined specimens of adventive casuals in C and S Europe. The name was reintroduced into current use by Thellung (1914), Aellen (1959), Soó (1980: 460), Hügin (1987), Raus (1997, see Table 1) and Pedersen (1999). There is, however, much disagreement among flora-writers on the taxonomic rank of *A. quitensis* and *A. hybridus* (summarized in Bayón 2015: 284–285), and it seems floristically rather unhelpful to again hide away the former in the latter, either as a plain synonym (Coons 1977) or at any infraspecific rank (Covas 1941; Costea & al. 2001a; Bayón 2015). *Amaranthus quitensis* may yet also be found in Albania (see above), Bulgaria and North Macedonia, where to date it simply has not been keyed out and distinguished from *A. hybridus*.

19. *Amaranthus retroflexus* L., Sp. Pl.: 991. 1753. – Lectotype (designated by Townsend 1974: 12): Herb. Linn. No. 1117.22 (LINN).

= *Amaranthus delilei* J. A. Richt. & Loret in Bull. Soc. Bot. France 13: 316. 1866 ≡ *Amaranthus retroflexus* var. *delilei* (J. A. Richt. & Loret) Thell. in Vierteljahrsschr. Naturf. Ges. Zürich 52: 442. 1907 ≡ *Amaranthus retroflexus* subsp. *delilei* (J. A. Richt. & Loret) Tzvelev in Novost Sist. Vyssh. Rast. 32: 183. 2000. – Type: not designated.

Remarks — *Amaranthus retroflexus* is native to North America, from SE Canada to NE Mexico. It is introduced as an agricultural and ruderal weed in warm-temperate regions worldwide (Bayón 2015: 294) and in Europe was already common around 1800 AD (Thellung 1914: 257). Naturalized in Greece (Arianoutsou & al. 2010), it is the most widespread amaranth countrywide, formerly locally cultivated as vegetable crop (βλίτα, see Heldreich 1862). The name *A. delilei* applies to plants with short, weak (less rigid) floral bracts scarcely exceeding the perianth (Loret 1866); they are hardly distinct from *A. retroflexus* (Thellung 1912). Putative hybrids with *A. cruentus*, *A. hybridus* and *A. powellii* have been reported from Greece (Krigas & Kokkini 2004).

20. *Amaranthus scleropoides* Uline & W. L. Bray in Bot. Gaz. 19: 316. 1894 ≡ *Amaranthus blitoides* var. *scleropoides* (Uline & W. L. Bray) Thell. in Ascherson & Graebner, Syn. Mitteleur. Fl. 5 (1. Abt.): 293. 1914. – Lectotype (designated by Henrickson 1999: 790): North America, U.S.A., Texas, Western Texas to El Paso, 2 Aug 1849, *Wright 582* (GH GH00037010; isolectotype: US US00106262).

Remarks — *Amaranthus scleropoides* is introduced as a casual alien with unknown status along the Black Sea coast of Bulgaria (Assyov & al. 2012: 66; Iamonico 2015a) and is not known from Greece so far. In its native range (Texas, NW Mexico; Mosyakin & Robertson 2003), it occupies seasonally wet, disturbed habitats. To raise awareness of this possibly spreading xenophyte, the main characters are given here (based on Mosyakin & Robertson 2003: 433; Bayón 2015: 356–357): plant annual, glabrous; stems ascending to prostrate, erect when young, 10–60 cm long; leaves petiolate, elliptic to lanceolate, 1.0–3.0 × 0.3–2.0 cm; inflorescence arranged in axillary clusters from base to apex, with axes thickened and inflated, becoming indurate at maturity (only so in *A. scleropoides* and *A. crassipes*); floral bracts keeled (only so in *A. scleropoides* and *A. crassipes*), ovate-triangular, minute; perianth segments 5, narrowly spathulate, slightly clawed, claw indurate at maturity; fruit orbicular to compressed obovoid, 1.1–1.5 mm long, shorter than perianth, smooth to tuberculate in distal half, transversely dehiscent (circumscissile). *Amaranthus crassipes*, native to South America and doubtfully reported once from Italy (Iamonico 2011: 208–209; 2015b: 67), differs in its markedly decumbent growth form and conspicuously tuberculate, indehiscent fruits (Iamonico 2011: 213; Bayón 2015: 319).

21. *Amaranthus spinosus* L., Sp. Pl.: 991. 1753. – Lectotype (designated by Fawcett & Rendle 1914: 130): Herb. Linn. No. 1117.27 (LINN).

Remarks — Native to the lowlands of tropical America, from NE Mexico to N Argentina, *Amaranthus spinosus* spread as a pantropical weed and is now introduced to warm-temperate regions of North America, Europe (scattered), Africa, E Asia and Australia (Bayón 2015: 295; POWO 2022). It is a valued food plant in Africa and Asia (from India to the Philippines) and can be a noxious weed in rice cultivation. It is a rare casual alien in Greece, not naturalized (Arianoutsou & al. 2010), easily recognized by its paired internodal spines and so far reported from the Nomoi of Attiki, Lakonia, Pieria and Thessaloniki. It is also known to occur in Albania, North Macedonia, Bulgaria and Turkey (Iamonico 2015a). According to Song & al. (2000), this taxonomically isolated species, the sole member of *A.* sect. *Centrusa* Griseb., occupies an evolutionarily basal position for the clades of *A.* subg. *Amaranthus* (*A.* sect. *Amaranthus*) and *A.* subg. *Albersia* (Kunth) Gren. & Godr. (*A.* sect. *Blitopsis* Dumort.); it also shows some degree of morphological transition toward dioecious amaranths of *A.* subg. *Acnida*, either indicating a phylogenetic relationship or a parallel evolution (Mosyakin & Robertson 1996).

22. *Amaranthus standleyanus* Parodi ex Covas in Darwiniana 5: 339. 1941. – Holotype: South America, Argentina, Tucumán, Amaicha, 2 Feb 1933, *Parodi 11040* (F F685296).

= *Amaranthus vulgatissimus* Thell. in Ascherson & Graebner, Syn. Mitteleur. Fl. 5 (1. Abt.): 343. 1914, nom illeg. [non *A. vulgatissimus* Speg. in Anal. Mus. Nac. Buenos Aires 7: 135. 1902]. – Holotype: South America, Argentina, Salta, Metán, *Spegazzini 167* (Z Z000000249).

Remarks — Amaranthus standleyanus resembles *A. crispus* with respect to the number of perianth segments, (4 or)5, and the indehiscent fruit, but differs on its smooth, entire leaf margins (vs undulate-crenate in *A. crispus*) and the perianth segments being reflexed in fruit (vs connivent in *A. crispus*). Native to Argentina, Bolivia, Paraguay and Uruguay (Pedersen 1999: 25; Bayón 2015: 359), it was erroneously reported as naturalized in Turkey-in-Europe (Greuter & al. 1984: 47) but there is no floristic basis for this, corroborated by herbarium material. Accordingly, the record for European Turkey has to be removed from the Euro+Med PlantBase (Iamonico 2015a).

23. *Amaranthus tricolor* L., Sp. Pl.: 989. 1753. – Lectotype (designated by Townsend 1974: 14): Herb. Linn. No. 1117.7 (LINN).

= *Amaranthus melancholicus* L., Sp. Pl.: 989. 1753 ≡ *Amaranthus tricolor* var. *melancholicus* (L.) Lam. & Monnet in Lamarck, Encycl. 1: 115. 1783. – Lectotype (designated by Townsend 1974: 11): Herb. Linn. No. 1117.4 (LINN).

= *Amaranthus tristis* L., Sp. Pl. 2: 989. 1753 ≡ *Amaranthus tricolor* var. *tristis* (L.) Thell. in Ascherson & Graebner, Syn. Mitteleur. Fl. 5 (1. Abt.): 274. 1914 ≡ *Amaranthus tricolor* subsp. *tristis* (L.) Aellen in Hegi, Ill. Fl. Mitt.-Eur. 3(2): 495. 1959. – Lectotype (designated by Iamonico 2014b: 149): Herb. Linn. No. 1117.11 (LINN).

= *Amaranthus mangostanus* L., Cent. Pl. I: 32. 1755 ≡ *Amaranthus tricolor* var. *mangostanus* (L.) Thell. in Ascherson & Graebner, Syn. Mitteleur. Fl. 5 (1. Abt.): 274. 1914 ≡ *Amaranthus tricolor* subsp. *mangostanus* (L.) Aellen, in Hegi, Ill. Fl. Mitt.-Eur. 3(2): 495. 1959. – Lectotype (designated by Iamonico 2014b: 147): Herb. Linn. No. 1117.10 (LINN).

= *Amaranthus polygamus* L., Cent. Pl. I : 32. 1755 ≡ *Amaranthus tricolor* var. *polygamus* (L.) Aellen in Hegi, Ill. Fl. Mitt.-Eur. 3(2): 495. 1959. – Lectotype (designated by Iamonico 2014b: 148): Herb. Linn. No. 1117.9 (LINN).

Remarks — Amaranthus tricolor was reported as naturalized in European Turkey (Roy & al. 2022; Iamonico 2015a) but certainly in error; a single 19th century record is known from Turkey-in-Europe ("cultivated in gardens, and sometimes escapes", Aellen 1967; Baytop & Demiriz 1981). The species, native to Asia from Pakistan E to Japan and Indonesia (Bayón 2015: 367), was never recollected in the area and was accordingly not counted as a member of the Turkish flora by Aellen (1967: 343); there are also no past or present records from Greece.

24. *Amaranthus viridis* L., Sp. Pl., ed. 2: 1405. 1763. – Lectotype (designated by Fawcett & Rendle 1914: 131): Herb. Linn. No. 1117.15 (LINN).

– "*Amaranthus gracilis*" auct. [non *Amaranthus gracilis* Desf., Tabl. École Bot.: 43. 1804 nec Poir. in Lam., Encycl. Méthod., Suppl. 1: 312. 1810; see Iamonico 2015b, 2016b].

Remarks — Native from SE Mexico to N Argentina, this species is introduced as a ruderal weed in tropical, subtropical and warm-temperate regions worldwide (Bayón 2015: 370). An established xenophyte in Greece (Arianoutsou & al. 2010), it is known from most parts of the country (except North Pindos and North Central, perhaps due to its lacking frost resistance; there are also no records from North Macedonia and Bulgaria, see Iamonico 2015a). It is also given as naturalized in coastal Albania (Barina & al. 2017; 2018) and European Turkey (Iamonico 2015a, based on Roy & al. 2022). Unfortunately, the name *Amaranthus viridis* has been misapplied to *A. blitum* in influential Greek floras (Halácsy 1904; Rechinger 1944), which makes previous floristic records doubtful unless specimens are revised. Forms of *A. emarginatus*, showing an elongate terminal spike-like inflorescence similar to that of *A. viridis*, differ sufficiently by their smaller, apically emarginate to bilobate leaves and constantly smaller fruit and seed dimensions.

25. *Amaranthus watsonii* Standl. in Bull. Torrey Bot. Club 41: 505. 1914. – Holotype: North America, Mexico, Sonora, on sand near Guaymas, Oct 1887, *Palmer 312* (US US00106268; isotypes: US US01013502, US US01013512).

Remarks — This is a dioecious taxon native to sandy and weakly saline coastal and inland areas of SW North America, in the U.S.A. and NW Mexico (Mosyakin & Robertson 2003: 418). In Europe it is reported as a rare casual in Britain (Brenan 1961) and Greece (Arianoutsou & al. 2010). It was found once in Peloponnisos S of Gytheio in 2003 (Raus 2006) but has not been recorded since; the species may have vanished in the country. It differs from *Amaranthus palmeri* chiefly on its broadly spathulate, obtuse, pubescent perianth segments of the female flowers (Sauer 1955: 38).

26. *Polycnemum arvense* L., Sp. Pl.: 35. 1753. – Lectotype (designated by Hedge in Jarvis & al. 1993: 78): Herb. Linn. No. 55.2 (LINN).

= *Polycnemum arvense* var. *minus* Döll, Rhein. Fl.: 287. 1843 ≡ *Polycnemum minus* (Döll) Kitt., Taschenb. Fl. Deutschl., ed. 3: 327. 1853 ≡ *Polycnemum arvense* subsp. *minus* (Döll) Čelak., Prodr. Fl. Böhm. 2: 156. 1871. – Type: not designated.

Remarks — The species is native to temperate and Mediterranean Europe and W Asia, found in all countries of the S Balkan peninsula (Iamonico 2015a) and in mainland Greece very scattered N of the Gulf of Korinthos (Ipiros, Thessalia, Makedonia) and on some larger Aegean islands (Evvia, Thasos, Samothraki). A previous record from the Ionian islands (Kerkyra, see Jalas &

Suominen 1980: map 479) was already doubted by Tan (1997) and has not been confirmed (Flora Ionica Working Group 2016+). As an autumnal, easily overlooked species of mostly seminatural habitats, it is probably more widespread than the present data indicate.

27. *Polycnemum heuffelii* A. F. Láng in Hornschuch, Syll. Pl. Nov. 2: 219. 1828. – Lectotype (designated by Iamonico & Somlyay 2014: 118): Europe, Hungary, in silvis collium arenosorum ad Veresegyház C[omi]t[a]tus Pestiensis, *Heuffel* (BP BP707539).

Remarks — Records from Greece (South and North Pindos, Haussknecht 1897: 57) ascribed to *Polycnemum heuffelii*, a steppe species from subcontinental Europe (Austria to Ukraine, extending to NE Bulgaria, see Assyov & al. 2012: 322), are based on misidentifications of specimens of *P. arvense* (Tan 1997: 110). The species was mapped for Greece, although in error, in Jalas & Suominen (1980: 11, map 482) and was accepted to occur in Greece by Greuter & al. (1984: 306) and Ball (1993: 110). The record for Greece needs to be removed from the Euro+Med PlantBase (Iamonico 2015a).

28. *Polycnemum majus* A. Braun ex Bogenh. in Flora 24: 151. 1841 ≡ *Polycnemum arvense* var. *maximum* Bogenh. in Flora 23: 166. 1840 ≡ *Polycnemum arvense* var. *majus* (A. Braun ex Bogenh.) Döll, Rhein. Fl.: 287. 1843, nom. superfl. ≡ *Polycnemum arvense* subsp. *majus* (A. Braun ex Bogenh.) Čelak. in Sborn. Věd. Mus. Král. Čes. Odb. Přír. Math. 4: 65. 1870. – Lectotype (designated by Freitag & Iamonico 2015: 236): Europe, Germany, Rheinland-Pfalz, Martinstein an der Nahe, September 1838, *Bogenhardt* (JE JE-00021893).

= *Polycnemum majus* var. *mediterraneum* Beck in Reichenbach, Icon. Fl. Germ. Helv. 24: 93. 1907 ≡ *Polycnemum majus* subsp. *mediterraneum* (Beck) Vul'f, Fl. Kryma 2: 87. 1947. – Type: not designated.

Remarks — The species is native to C, S and E Europe and W Asia, occurring in all Balkan countries (Iamonico 2015a). It is scattered in N mainland Greece (Strid & Tan (1997: map 204), additionally reported from the N Aegean island of Samothraki (Biel & Tan 2014). Like *Polycnemum arvense*, it is easily overlooked and probably more widespread in Greece than the present data indicate.

Polycnemum majus was initially described as a variety of *P. arvense* by its discoverer Carl Christian Gmelin and his student Karl (Carl) Friedrich Schimper (Gmelin 1826: 28; Döll 1843: 287), but soon became accepted as a separate species constantly differing from *P. arvense* by non-modificative, morphological discontinuities (Koch 1846: 715; Döll 1859: 616; Hallier & Brand 1907: 2202). A hill named Turmberg (Thurmberg) near the town of Durlach (now a suburb of the city of Karlsruhe, SW Germany) represents the locus classicus (Seybold 1990: 479) where, in 1810, Carl Christian Gmelin, then director of the botanical garden at Karlsruhe and at the same time biology teacher of the young Alexander Braun (Caspary 1877), first encountered a *Polycnemum* population with plants markedly deviating from *P. arvense* in larger leaf, bract and fruit dimensions ("*Polycnemum arvense*. var. major pedalis, sesquipedalis, multo-crassior, prostrata et adscendens.", Gmelin 1826: 28; specimen in KR!). Karl ("Carl") Friedrich Schimper (Leutz 1890; Mägdefrau 1968), a close, lifelong academic friend to Alexander Braun, corresponded with the latter on a pending "*P. arvense* var. *majus*" in a letter of 1826 (Döll 1843: 287). However, a valid name for the taxon under discussion remained unpublished (sec. W. D. J. Koch in litt., cited in Bogenhard 1841: 151) and was not yet to be found in the basic C European flora of 1838 (Koch 1838: 602). Only in 1841 was *P. majus* validly published at specific rank by Alexander Braun, then professor of botany at the Polytechnic School of Karlsruhe and in 1837 appointed director of the "Naturaliencabinett" what is today the Natural History Museum at Karlsruhe (Wunschmann 1903). Publication of the new species was executed in the context of a floristic paper on noteworthy plants of SW Germany by a young German pharmacist-in-training, Carl Bogenhard (Bogenhard 1841), who explicitly acknowledged Alexander Braun by ascribing the name to him. The new species was promptly incorporated in the second edition of Wilhelm Daniel Joseph Koch's basic flora (Koch 1846: 715, as "*P. majus* (Alex. Braun.)"). A single extant specimen in the herbarium of the Staatliches Museum für Naturkunde Karlsruhe (KR), labelled "*Polycnemum majus* A. Br., Durlach, A. Braun" would have been suitable for lectotypification (A. Kleinsteuber, Karlsruhe, in litt.). This, however, is prevented by Freitag & Ianonico (2015), who chose a specimen named one year earlier as *P. arvense* var. *maximum* Bogenh. (Bogenhard 1840: 164) to serve as the lectotype for *P. majus*, simultaneously considering the latter to be a replacement name for the former (Freitag & Ianonico 2015: 236). Bogenhard (1841) ascribed the name to Braun, but not the validating diagnosis, which was his own, hence under *Shenzhen Code* Art. 46.5 the name is to be attributed to "A. Braun ex Bogenh." or just "Bogenh." (Shultz 2003; Masson & Kadereit 2013; POWO 2022). The nomenclatural authorship "A. Braun in Bogenh." as advocated by influential basic floras and checklists (Koch 1846; Ball 1993; Hand & al. 2022) is to be corrected accordingly. A published incorrectness is, by the way, the fiction of "A. Brown" as the nomenclatural author of *P. majus* – just a slip of the pen in Iamonico (2013), nominating an imaginary chimaera among taxonomic authors which superficially associates Addison Brown, the co-editor of *An illustrated flora of the northern United States* […] (Britton & Brown 1896–1898), whose standardized author abbreviation reads "Britton

& A. Br." (sec. Brummitt & Powell 1992). The author abbreviation "A. Br." connected to vascular plants of Europe, however, refers invariably to Alexander Braun (see Raus 2007), whose pertinent standard abbreviation reads "A. Braun" (sec. Brummitt & Powell 1992).

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