South African Journal of Botany 114 (2018) 78–83

Contents lists available at ScienceDirect

South African Journal of Botany

journal homepage: www.elsevier.com/locate/sajb

Amaranthus tunetanus (Amaranthaceae), a new species from Tunisia and a diagnostic key to the North African taxa in subgen. *Albersia*

D. Iamonico [a,*], R. El Mokni [b,c]

[a] Laboratory of Phytogeography and Applied Geobotany, Department DPTA, Section Environment and Landscape, Sapienza University of Rome, Rome IT-00196, Italy
[b] Department of Biology, University of Carthage, TN-7021 Bizerta, Tunisia
[c] Department of Botany and Plant Biology, Faculty of Pharmacy of Monastir, University of Monastir, Tunisia

ARTICLE INFO

Article history:
Received 26 March 2017
Received in revised form 8 October 2017
Accepted 14 October 2017
Available online xxxx

Edited by GV Goodman-Cron

Keywords:
Amaranthus
Jemmel
Monastir
New species
Africa

ABSTRACT

A new species of *Amaranthus* (Amaranthaceae), *A. tunetanus sp. nov.* from Monastir Governorate (central Tunisia) is described and illustrated. The new species is morphologically similar to *A. crassipes*, *A. crispus*, *A. graecizans* subsp. *aschersonianus*, and *A. scleropoides* from which it differs mainly by characters of synflorescences and flowers. Distribution in Tunisia, notes of its preferred habitat, phenology, and the IUCN status of conservation are also provided. A diagnostic key to the 14 taxa of subgen. *Albersia* occurring in North Africa is also presented.

1. Introduction

Amaranthus L. (Amaranthaceae Juss.) is a genus of about 70 mostly annual monoecious and dioecious species with a worldwide distribution. Approximately 40 species are native to the Americas, the remaining ones to all the other continents except Arctic and Antarctic regions (see e.g., Mosyakin and Robertson, 2003; Iamonico, 2015a). Several American species are used as ornamentals, and some of them are able to escape from cultivation, negatively impacting the agricultural systems through a reduction in both productivity and crop quality (see Iamonico, 2010).

The genus *Amaranthus* is critical from a taxonomic point of view due to its high phenotypic variability which has resulted in the current nomenclatural disorder and misapplication of several names (see e.g., Costea et al., 2001; Bayón, 2015; Iamonico, 2016a, 2016b, 2016c). According to Le Floc'h et al. (2010) and Iamonico (2015b), 10 species of *Amaranthus* currently occur in Tunisia.

As part of an ongoing investigation on the Tunisian *Amaranthaceae* s. lat. (Sukhorukov et al., 2016; Iamonico and El Mokni, 2016, 2017), we found some populations whose morphological characteristics do not match those of any other known *Amaranthus* taxon. We here propose *A. tunetanus* Iamonico & El Mokni *sp. nov.* as a new species to science.

2. Material and methods

The work is based on field surveys, analysis of relevant literature and examination of specimens preserved at CAT, G, FI, HFLA, K, P, RO, NY, and US (acronyms according to Thiers, 2017+) and in the personal collection of one of the authors (R. El Mokni) deposited in the herbaria of the Faculty of Pharmacy of Monastir and the Faculty of Sciences of Bizerta (not listed in *Index Herbariorum*).

3. Taxonomic treatment

Amaranthus tunetanus Iamonico & El Mokni *sp. nov.*

Type: Tunisia. Monastir: Monastir south, 35°46′23.92″ N, 10°40′51.57″ E, meadows and roadsides, 3 m a.s.l., 13 Jan 2016, *El Mokni 4163* (HFLA-4163, holo.!; *Herbarium El Mokni* at the Faculty of Pharmacy of Monastir, iso.!) Fig. 1.

3.1. Diagnosis

Herbs 30–80 cm tall, dioecious, annual (therophyte). Stems erect, glabrous, brownish or reddish, branched. Leaves green or red (sometimes

* Corresponding author.
E-mail address: d.iamonico@yahoo.it (D. Iamonico).

https://doi.org/10.1016/j.sajb.2017.10.011
0254-6299/

Fig. 1. Holotype of *Amaranthus tunetanus* (HFLA-4163!).

green in the first half of the blade and red in the distal part), ovate, rhomboidal, (0.5–)1.0–2.2(−2.5) × (0.2–)0.5–1.0(−1.6) cm, glabrous, margins entire or slightly undulate, sometimes reddish, apex obtuse with apical mucro, base cuneate, petiolate; petiole (0.1–)0.3–2.5 cm long], with prominent white veins on the abaxial surface. Synflorescences in either axillary glomerules or a single terminal spike in the same individual; the terminal synflorescence is erect, dense or interrupted, green. Floral bracts 1, usually light green, ovate, (1.7−)2.0–2.5(−2.7) × (2.3−)2.5–3.0(−3.2) mm, about half the length of the perianth, apex acuminate-mucronate, margin entire, glabrous. Staminate flowers with 5 tepals, about equal to each other, lanceolate, 3.0–4.0(−4.5) × 1.0–1.3 mm, apex acute, mostly awned; stamens 5. Pistillate flowers with 5 tepals [(2.7–)3.0–5.5(−5.7) × 2.3–2.5 mm], connate in the proximal 1/4–1/3, spathulate with the distal part expanded, hyaline distally (veins of tepals not occurring in the hyaline part), and an apical mucro up to 0.4 mm long, median vein sometimes red in color; style branches more or less erect; stigmas 2(−3). Fruit indehiscent, brown, subglobose to ellipsoidal, (1.5–3.0 × 1.0–2.5 mm), slightly longer than the perianth, and verrucose at maturity. Seed lenticular, 0.9–1.0(−1.1) mm in diameter, dark, shiny, smooth at the center, and slightly striate on the margin (width of the striate margin about ¼ of the diameter of seed).

3.2. Etymology

The species epithet is dedicated to the country Tunisia.

3.3. Iconography

See Fig. 2.

3.4. Proposed vernacular name

Tunisian amarant.

3.5. Phenology

Two periods of flowering and fruiting were observed in the populations found. The first period ranges from November to February

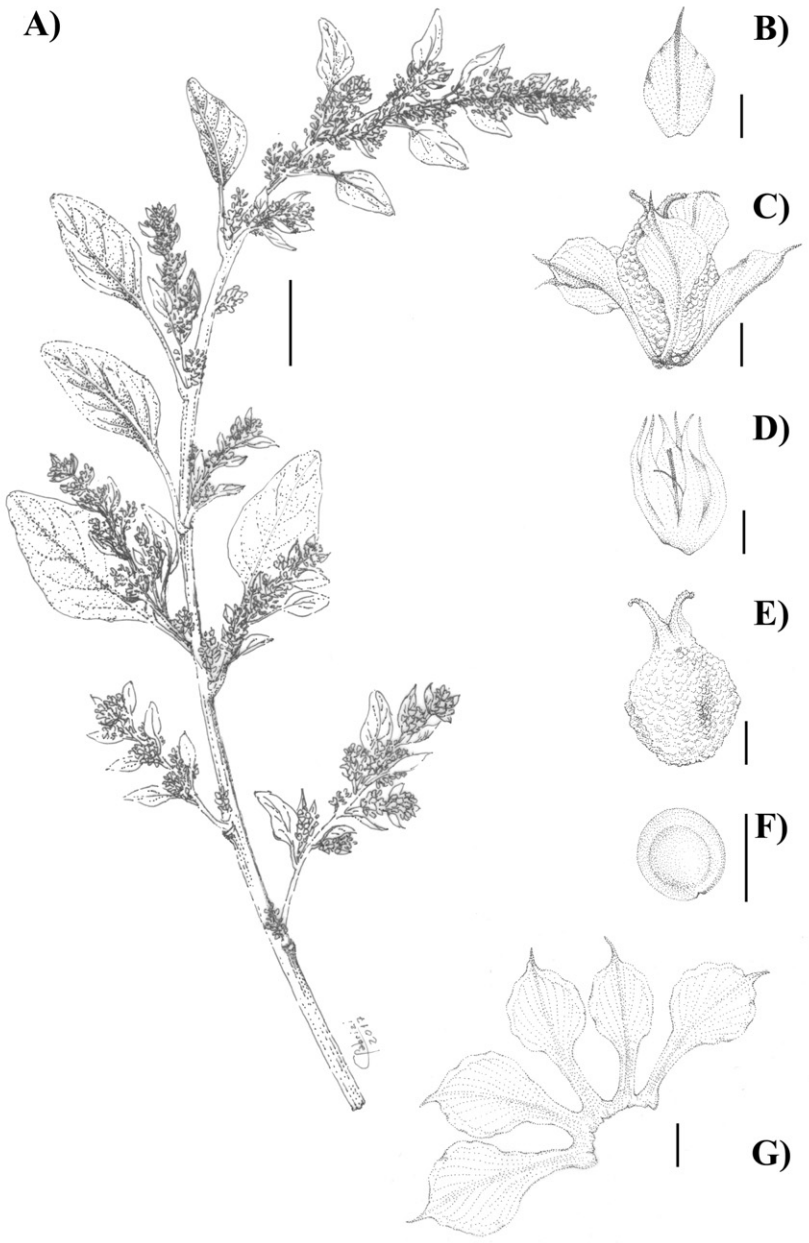

Fig. 2. *Amaranthus tunetanus*: A) plant, B) bract, C) female flower, D) male flower, E) fruit, F) seed, G) opened perianth. Scale bars: 1 cm (plant), 1 mm (bract, flowers, fruit, and seed) (drawing by C. Fabrizi from the holotype).

(flowering time November–January; fruiting time December–February), the second period ranges from April to July (flowering time April–June; fruiting time May–July).

3.6. Distribution and habitat

Amaranthus tunetanus is restricted to two localities of the Monastir Governorate: Monastir (two populations), and Jemmel (two populations). The species grows on clay and sandy substrates in meadows, margins of cultivated fields and railroads, uncultivated lands, and flower beds, at 32 m a.s.l. (type recorded at 3 m a.s.l.).

3.7. Origin status (sensu Pyšek et al., 2004)

The question regarding the status as native or not to the region is a crucial matter (see e.g., Pyšek et al., 2004). Webb (1985) and Preston (1986) provided the following useful criteria for presuming the origin status of a taxon: paleobotanical data, historical records, habitat, geographical distribution, genetic diversity, reproductive biology, and related phytophagous. According to Pyšek et al. (2004), most of these criteria are still relevant. Lacking desirable fossil and/or DNA evidence for *Amaranthus tunetanus*, we must consider the other criteria for evidence of its native status.

No historical records were confirmed for *Amaranthus tunetanus* as we have not traced specimens that could be matched to the new species, including any of the European and American herbaria consulted (see e.g. the list of 45 herbaria in Iamonico, 2015a). The distribution area of the new Tunisian amarant appears to be restricted to the central-eastern part of Tunisia. According to Webb (1985: 233–234), the restricted distribution of *A. tunetanus* indicates that it is a native of Tunisia. In addition, another criterion to which we can refer is the reproductive biology (Webb, 1985: 235). Since *Amaranthus tunetanus* is observed to reproduce only by seeds, we may assume that *A. tunatanus* is native.

In contrast, its preference for man-made habitats suggests that *A. tunetanus* is an alien species (Webb, 1985: 234). Pyšek et al. (2002, 2004) specified that plants introduced to a region after ca. 1500 should be named 'Archeophytes'. Pyšek et al. (2004: 138) also pointed out that "Since many archaeophytes now occur only in human-made habitats, we can ask, on the basis of the knowledge of their ecology, whether we can identify their potentially native habitat in the landscape before it was affected by people". Hence, *A. tunetanus* could be considered as archeophyte, but potentially native.

In addition to the criteria proposed by Webb (1985) and Preston (1986), and the discussion made by Pyšek et al. (2002, 2004), we can consider the following taxonomic and nomenclatural question: are the plants found in central-eastern Tunisia already been named elsewhere? No plant showing morphological characteristics of *A. tunetanus* appears to be described up till now. This is based on our I) studies at national or continental levels (e.g., Iamonico, 2015a, 2015b; Iamonico and Das, 2014; Iamonico and El Mokni, 2017), II) analysis of recent literature (e.g., Bayón, 2015; Das, 2015; Iamonico, 2015b; Sánchez-Del Pino et al., 2017 – see also literature therein) and III) discussions with many other Amarants' experts (e.g., N. Bayón from S-America, I. Sánchez-Del Pino from C-America, S. Das from India, J. Palmer from Australia). Furthermore, any of the hundred names which were studies from the nomenclatural point of view (analysis of protologues, original material and types) by one of us (DI, see see Iamonico, 2014a, 2014b, 2016a, 2016b; Iamonico and Clementi, 2016) matched the Tunisian material of *A. tunetanus*.

All things stated, we here consider *Amaranthus tunetanus* as a native species of Tunisia.

3.8. Conservation status

The distance between the two sites where *A. tunetanus* occurs is about 30 km. The Monastir populations are about 4 to 5 km apart while the Jemmel's populations are 3–4 km apart. The known AOO is about 27.87 km^2, while the EOO is 110.94 km^2. No protection plans exist for the areas where the new species occurs. Threats are represented by: residential and commercial development (urban areas), transportation and service corridors (roads), human intrusions and disturbance (recreational activities), and pollution (agricultural effluents). On the basis of the application of the IUCN criteria B1 and B2a, biii (2014), *A. tunetanus* can be categorized as Endangered (EN).

3.9. Taxonomic notes

Amaranthus tunetanus is morphologically similar to species belonging to the subgenus *Albersia* (Kunth) Gren. & Godr. sect. *Pentamorion* (G.Beck) Mosyakin & K.R.Robertson sensu Mosyakin and Robertson (1996), namely: *A. crassipes* Schltdl. s.str., *A. crispus* (Lesp. & Thévenau) A. Braun ex J.M.Coult. & S.Watson, *A. scleropoides* Uline & W.L., and *A. standleyanus* Parodi ex Covas (Table 1). All these species share a common character, viz. the shape of the tepals which are spathulate and expanded distally. However, they differ in a number of ways: *A. scleropoides* has circumscissile dehiscent fruits, whereas the fruits of *A. tunetanus* as the other species (i.e. *A. crassipes*, *A. crispus*, *A. standleyanus*) are indehiscent. The new Tunisian species differs from *A. scleropoides* and *A. crassipes* in having the synflorescence not thickened at any stage of the life cycle, while in the latter two species the synflorescence is thickened, becoming indurate (= hardened) at maturity, a unique feature of *Amaranthus*. *A. standleyanus* differs from *A. tunetanus* by the following characters: shape and length of bracts [ovate-lanceolate, 0.5–2.0 vs. narrow ovate, (2.3 −)2.5–3.0(−3.2) mm], structure of the perianth (tepals free vs. connate in the proximal 1/4–1/3), expansion of tepals of pistillate flowers (uniform vs. hyaline in the distal part), length of tepals of pistillate flowers [1.5–2.8 vs. (2.7–)3.0–5.5(−5.7) mm]. *A. crispus* can be easily distinguished from *A. tunetanus* by its habit (prostrate to ascendent vs. erect), leaf blade margin (highly undulate vs. entire or slightly undulate), expansion of tepals of pistillate flowers (uniform vs. hyaline

Table 1
Morphological comparison among *Amaranthus crassipes*, *A. crispus*, *A. graecizans* subsp. *thellungianus*, *A. scleropoides*, *A. standleyanus*, and *A. tunetanus*. The characters which are diagnostic among *A tunetanus* and the other five taxa are underlined.

	A. crassipes	*A. crispus*	*A. graecizans* subsp. *thellungianus*	*A. scleropoides*	*A. standleyanus*	*A. tunetanus*
Habit	Mostly decumbent	Prostrate to ascendent	Erect, ascending or decumbent	Ascending to decumbent	Erect to decumbent	Erect
Leaves petiole length (cm)	0.1–0.3	2.0–10.0	0.3–2.7	0.2–2.5	1.8–5.0	0.3–2.5
Leaves blade (margin)	Entire	Highly undulate	Entire	Entire	Entire or slightly undulate	Entire or slightly undulate
Synflorescence	Axillary glomerules only, thickened and indurate at maturity	Axillary glomerules only, neither thickened nor indurate	Axillary glomerules only, neither thickened nor indurate	Axillary glomerules only, thickened and indurate at maturity	Axillary glomerules and terminal spike − like, neither thickened nor indurate	Axillary glomerules only, neither thickened nor indurate
Bract shape and length (mm)	Deltoid, 0.5–1.2	Ovate, 0.8–1.4	Ovate-lanceolate, (0.7 −)2.0–3.5(−4.0)	Ovate-triangular, 1.3–1.5	Ovate-lanceolate, 0.5–2.0	Ovate, (1.7 −)2.0–2.5(−2.7)
Staminate flowers length (mm)	1.5–3.0	1.3–1.8	1.1–1.3	(1.2 −)1.5–2.2	1.2–2.7	3.0–4.0(−4.5)
Pistillate flowers lenght (mm)	1.2–2.0	1.3–2.0	1.2–1.9	1.2–2.5	1.5–2.8	(2.7 −)3.0–5.5(−5.7)
Perianth (pistillate flowers)	Connate in the proximal 1/5–1/4	Free	Free	Connate in the proximal 1/5–1/4	Free	Connate in the proximal 1/4–1/3
Tepals structure (pistillate flowers)	Spatulate and expanded distally, expansion hyaline in the distal part	Spatulate and expanded distally, expansion uniform	Ovate-lanceolate not expanded distal part	Spatulate and expanded distally, expansion uniform	Spatulate and expanded distally, expansion uniform	Spatulate and expanded distally, expansion hyaline in the distal part
Fruit	Indehiscent, smooth on the first half, verrucose on the distal part	Indehiscent, verrucose	Dehiscent, verrucose	Dehiscent, smooth on the first half, verrucose on the distal part	Indehiscent, verrucose	Indehiscent, verrucose
Seed color	Black on the center, brown-reddish on the margins	Brown-reddish	Dark	Dark-brownish to black	Brown-reddish to black	Black
Seed surface	Smooth	Smooth at the centre, dotted on the margin	Smooth at the centre, reticulate on the margin	Smooth	Smooth	Smooth at the centre, slightly striate on the margin

in the distal part), length of tepals of pistillate flowers [1.3–2.0 vs. (2.7–)3.0–5.5(−5.7) mm], seed surface (dotted on the margin vs. slightly striate on the margin).

A further taxon which could be confused with *A. tunetanus*, due to their leaf shape and the terminal spike-like synflorescence, is *A. graecizans* L. subsp. *aschersonianus* Thell. The main difference between these two taxa is that the tepals are spathulate with an expanded distal part in *A. tunetanus*, as opposed to ovate-lanceolate without an expanded distal part in *A. graecizans*.

3.10. Taxonomic notes on Amaranthus subgen. Albersia in North Africa

According to SANBI (2012 and literature therein), Iamonico (2015b) and Sukhorukov et al. (2016), the number of taxa in subgen. *Albersia* sensu Mosyakin and Robertson (1996) currently occurring in North Africa is 14 (including three subspecies and two varieties). We here present a diagnostic key to these taxa (the sexual characters reported in the key refer to the pistillate flowers – see e.g., Bayón, 2015; Iamonico, 2015a).

Key to the N-African species of Amaranthus belonging to subgen. *Albersia* sensu Mosyakin and Robertson, 1996:

1a. Tepals 2 ..... *A. deflexus*
1b. Tepals more than 2 2
2a. Tepals 3 3
3a. Bracts spinescent; stem whitish to white-greenish ..... *A. albus*
3b. Bracts non spinescent; stem never whitish to white-greenish 4
4a. Synflorescence arranged in glomerules 5
5a Leaf apex emarginate to bilobed ..... *A. emarginatus*
5b. Leaf apex acute 6
6a. Fruit shorter than the tepals ..... *A. tricolor*
6b. Fruit as long as the tepals ..... *A. graecizans s.lat.*
7a. Lamina of leaf lanceolate (ratio length/width 3.0-6.0)..... *A. graecizans* subsp. *graecizans*
7b. Lamina of leaf ovate-rhomboidal (ratio length/width 1.5-2.5)..... *A. graecizans* subsp. *sylvestris*
4b. Synflorescence arranged in terminal spike-like structures 5
8a. Tepals spatulate with expanded distal part 8
9a. Bracts ovate-lanceolate, 0.5–2.0, tepals 1.5–2.8 mm long, free, with expansion uniform ..... *A. standleyanus*
9b. Bracts narrow ovate, (2.3−)2.5–3.0(−3.2) mm, tepals (2.7–)3.0–5.5(−5.7) mm long, connate in the proximal 1/4–1/3, with expansion uniform vs. hyaline in the distal part ..... *A. tunetanus*
8b. Tepals ovate to lanceolate, never spatulate with expanded distal 7
10a. Fruit rugose to strongly rugose on surface 10
11a. Fruit indehiscent ..... *A. viridis*
11b. Fruit dehiscent ..... *A. graecizans* subsp. *thellungianus*
10b. Fruit smooth or slightly rugose on surface; stem prostrate or ascending 10
12a. Fruit pear-shaped, 2 times longer than the tepals ..... *A. deflexus*
12b. Fruit subglobose or ellipsoidal (up to 1.5 times longer than tepals)..... *A. blitum s.lat.*
13a. Seed diameter 1.1–1.2 mm ..... *A. blitum* var. *blitum*
13b. Seed diameter 1.3–1.9 mm ..... *A. blitum* var. *oleraceus*
2b. Tepals more than 3 8
14a. Tepals 4, leaf blades lanceolate to oblong-spathulate with marginal white vein ..... *A. blitoides*
14b. Tepals 5, leaf blades linear to linear-lanceolate, without marginal white vein ..... *A. muricatus*

3.11. Representative specimens examined

Tunisia. MONASTIR: **Monastir north**, 35°45′55.55″N, 10°49′48.00″E, flowerbeds in public gardens, about 16 m a.s.l., 03 Oct 2015, *El Mokni s.n.* (*Herb. El Mokni*!); ibidem 18 Mar 2016, *El Mokni s.n.* (*Herb. El Mokni*!); ibidem, 11 Oct 2016, *El Mokni s.n.* (*Herb. El Mokni*!); ibidem, 06 Nov 2016, *El Mokni s.n.* (*Herb. El Mokni*!); **Monastir south**, 35°46′23.92″ N, 10°40′51.57″ E, meadows and roadsides, 3 m a.s.l., 23 Jul 2016, *El Mokni s.n.* (*Herb. El Mokni*!); **Zaouiet Kontich**, 35°39′02.63″ N, 10°46′06.77″E, margins of cultivated field and roadsides, about 30 m a.s.l., 21 Dec 2015, *El Mokni s.n.* (*Herb. El Mokni*!); **Jemmel**, 35°37′06.26″ N, 10°45′23.55″ E, uncultivated lands in urban areas, about 32 m a.s.l., 16 Jul 2016, *El Mokni s.n.* (*Herb. El Mokni*!).

Acknowledgements

Thanks are due to directors and curators of all quoted herbaria for their support during our visits or loan of specimens/photograph. We also thanks to R. Di Pietro (Rome) for providing some English suggestions, and to C. Fabrizi (Rome) for the excellent drawing of *Amaranthus tunetanus*. Many thanks to the anonymous reviewers for the useful comments given to improve the manuscript.

References

Bayón, N.B., 2015. Revision taxonomica de las especies monoicas de *Amaranthus* (Amaranthaceae): *Amaranthus* subg. *Amaranthus* y *Amaranthus* subg. *Albersia*'. Annals of the Missouri Botanical Garden 101, 261–383.
Costea, M., Sanders, A., Waines, G., 2001. Preliminary results towards a revision of the *Amaranthus hybridus* complex (Amaranthaceae). Sida 19, 931–974.
Das, S., 2015. *Amaranthus paganensis* (Amaranthaceae), a new species from West Bengal, India. Novon 23, 406–410.
Iamonico, D., 2010. Biology, life–strategy and invasiveness of *Amaranthus retroflexus* L. (Amaranthaceae) in central Italy: preliminary remarks. Botanica Serbica 34, 137–145.
Iamonico, D., 2014a. Lectotypification of Linnaean names in the genus *Amaranthus* L. (*Amaranthaceae*). Taxon 63:146–150. https://doi.org/10.12705/631.34.
Iamonico, D., 2014b. *Amarathus gangeticus* (Amaranthaceae), a name incertae sedis. Phytotaxa 162:299–300. https://doi.org/10.11646/phytotaxa.162.5.2.
Iamonico, D., 2015a. Taxonomic revision of the genus *Amaranthus* (Amaranthaceae) in Italy. Phytotaxa 199:1–84. https://doi.org/10.11646/phytotaxa.199.1.1.
Iamonico, D., 2015b. Amaranthaceae Juss. Euro+Med Plantbase - the Information Resource for Euro-Mediterranean Plant Diversity http://ww2.bgbm.org/EuroPlusMed/PTaxonDetail.asp?NameCache=Amaranthus&PTRefFk=7300000 (accessed 26 March 2017).
Iamonico, D., 2016a. Nomenclature survey of the genus *Amaranthus* (Amaranthaceae). 5. Moquin-Tandon's names. Phytotaxa 273:81–114. https://doi.org/10.11646/phytotaxa.273.2.1.
Iamonico, D., 2016b. Nomenclature survey of the genus *Amaranthus* (Amaranthaceae). 4. Detailed questions arising around the name *Amaranthus gracilis*. Botanica Serbica 40, 61–68.
Iamonico, D., 2016c. Nomenclature survey of the genus *Amaranthus* (Amaranthaceae). 3. Names linked to the Italian flora. Pl. Biosystems 150:519–531. https://doi.org/10.1080/11263504.2014.987188.
Iamonico, D., Clementi, M., 2016. Nomenclatural notes about the names in Amaranthaceae published by Roberto de Visiani. Hacquetia 15:49–54. https://doi.org/10.1515/hacq–2016–0003.
Iamonico, D., Das, S., 2014. *Amaranthus bengalense* (Amaranthaceae) a new species from India, with taxonomical notes on *A. blitum* aggregate. Phytotaxa 181, 293–300.
Iamonico, D., El Mokni, R., 2016. *Patellifolia procumbens* (C. Sm.) A. J. Scott., Ford-Lloyd et J.T. Williams. In: Raab-Straube, E., von Raus, T. (Eds.), Euro+Med–Cheklist Notulae 6. Willdenowia 46 (3):pp. 423–442. https://doi.org/10.3372/wi.46.46310.
Iamonico, D., El Mokni, R., 2017. *Amaranthus palmeri* (Amaranthaceae) in Tunisia, a second record for the continental African flora and nomenclatural notes on *A. sonoriensis nom. nov. pro A. palmeri* var. *glomeratus*. Bothalia 47, a2100. https://doi.org/10.4102/abc.v47i1.2100.
IUCN, 2014. Guidelines for Using the IUCN Red List Categories and Criteria, Version 11. http://www.iucnredlist.org/documents/RedListGuidelines.pdf (accessed 30 July 2017).
Le Floc'h, E., Boulos, L., Vela, E., 2010. Flore de Tunisie. Catalogue synonymique commenté. Banque Nationale de Gènes, Ministère de l'Environnement et du Développement Durable.

Mosyakin, S.L., Robertson, K.R., 1996. New infrageneric taxa and combination in *Amaranthus* (Amaranthaceae). Annales Botanici Fennici 33, 275–281.

Mosyakin, S.L., Robertson, K.R., 2003. *Amaranthus* L. In: Flora of North America Editorial Committee (Ed.), Flora of North America North of Mexico. Magnoliophyta: Caryophyllidae 4. Oxford University Press, Oxford, pp. 410–435.

Preston, C.D., 1986. An additional criterion for assessing native status. Watsonia 16, 83.

Pyšek, P., Sádlo, J., Mandák, B., 2002. Catalogue of alien plants of the Czech Republic. Preslia 74, 97–186.

Pyšek, P., Richardson, D.M., Rejemánek, M., Webster, G.L., Williamson, M., Kischner, J., 2004. Alien plants in checklist and floras: towards better communication between taxonomist and ecologist. Taxon 53, 131–143.

SANBI, 2012. Biodiversity of Life. *Amaranthus* L. http://www.ville-ge.ch/musinfo/bd/cjb/africa/resultat.php?efNom=Amaranthus&efFamille=&projet%5B%5D=FSA&projet%5B%5D=FTA&projet%5B%5D=FNA&projet%5B%5D=BDM&langue=an&pbRecherche=Search, Accessed date: 8 February 2017.

Sánchez-Del Pino, I., Pratt, D., Flores-Olvera, H., 2017. A new species of *Amaranthus* (Amaranthaceae) from Mexico. Phytotaxa 291, 201–208.

Sukhorukov, A.P., Martín-Bravo, S., Verloove, F., Marosi, A., Iamonico, D., Catarino, L., El Mokni, R., Daniel, T.F., Belyaeva, I.V., Kushunina, M., 2016. Chorological and taxonomic notes on African plants. Botany Letters 163:417–428. https://doi.org/10.1080/23818107.2016.1224731.

Thiers, B., 2017. Index Herbariorum: a global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium http://sweetgum.nybg.org/ih/ (accessed 30 July 2017).

Webb, D.A., 1985. What are the criteria for presuming native status? Watsonia 15, 231–236.