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Taxonomic revision of the genus *Amaranthus* (Amaranthaceae) in Italy

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Abstract

A taxonomic revision of the genus *Amaranthus* (Amaranthaceae) in Italy is here presented. Field surveys were carried out during the period 2006–2014. 58 herbaria (both European and American, including 12 personal herbaria) were consulted (more than 3,000 specimens were examined) as well as extensive literature was analized. Twenty-seven non-hybrid taxa (twenty-four species, and six varieties) are recognized (*A. crassipes* and *A. graecizans* subsp. *graecizans* are considered doubtful for the flora of Italy). Three taxa (*A. blitum*, *A. cacciatoi*, and *A. graecizans* subsp. *sylvestris*) are native, one (*A. bouchonii*) has doubtful origin, while the others are to be considered aliens, mostly neophytes native to the Americas. Information about nomenclature (accepted names, main synonyms, and types), morphology, chromosome number, chorology (for native taxa) or alien status (for exotic taxa, at national and regional levels), occurrence in Italy (at regional scale), ecology (preferential habitat, phenology, elevation), taxonomic annotations are provided for each taxon, as well as original photos were prepared. Diagnostic keys at species and infraspecific levels (for *A. blitum* subsp. *blitum* s.l., *A. emarginatus* s.l., and *A. graecizans* s.l.) are given. An isolectotype for the name *A. bouchonii* was found at Z. A list of the seven hybrids recorded and their main morphological characteristics are also given. Among them, *A.* × *mauritii* is recorded in the present study for the first time in Italy. The nomenclatural change *Amaranthus* × *pyxidatus comb. et stat. nov.* is proposed. Two specimens preserved at MPU are designated as lectotype and isolectotype of the name *A.* × *mauritii s.s.*, while for *A.* × *mauritii* f. *ramosissima* the holotype was found; the two names are to be considered heterotypic synonyms (new synonymy).

Key words: Aliens, Europe, hybridization, morphology, new combination, subgenus *Acnida*, subgenus *Albersia*, subgenus *Amaranthus*, taxonomy

Introduction

Amaranthus L. is a genus of about 70 mostly annual monoecious and dioecious species with worldwide distribution. Approximately 40 species are native to the Americas, the remaining ones to the other continents (see e.g., Costea *et al.* 2001a). Several American species are used as ornamentals and some of these are able to escape from cultivation mainly causing economical impacts in agricultural systems with reduction in productivity and crop quality.

This genus is critical from the taxonomical point of view due to its high phenotypic variability which led to nomenclatural disorder and misapplication of names (see e.g., Mosyakin & Robertson 1996, Costea *et al.* 2001a, Iamonico 2009a).

On the basis of the revision by Mosyakin & Robertson (1996), *Amaranthus* includes 3 subgenera: subgenus *Acnida* (L.) Aellen ex K.R.Robertson with 3 sections, subgenus *Albersia* (Kunth) Gren. & Godr. with 4 sections, and subgenus *Amaranthus*, with 3 sections and 2 subsections. However, the proposed classification does not appears conclusive and new taxa (at section and subsection levels) could be described (Mosyakin & Robertson 1996).

A comprehensive world monograph of the genus *Amaranthus* is lacking. Taxonomic works at continental level were rarely published [e.g., Palmer (2009) for Australia] or they are included in Flora projects [e.g., Aellen (1959) and Akeroyd (1993) for Europe, Mosyakin & Robertson (2003) for North America]. Most of the revisions at

national level can be found in the Floras [e.g., Carretero (1990), Raus (1997), Jonsell (2001), Bojian *et al.* (2003)], more rarely as separate papers [e.g., Brenan (1961), Costea (1998), Pinto & Velásquez (2010)].

Concerning Italy, *Amaranthus* is imperfectly known. No comprehensive works were published. Only three papers on *Amaranthus* were published in the twentieth century, but they refer to restricted areas (Cacciato 1966), to single herbarium collections (Lorenzoni & Ziliotto 1967) or to single taxon (Anzalone 1956). Fifteen other papers represent regional or provincial records, generally lacking morphological annotations (see Iamonico 2009a). Moreover, the number of specimens preserved in the Italian Herbaria is not adequate, with a very low number of exsiccata [the only good Italian collection is that of Alfredo Cacciato (1907–1986), kept in RO].

This research started in the year 2006 and led to the publication of several partial papers (Iamonico 2008a−d, 2009a−i 2010a−d, 2011b, 2012a−d, 2014c−e, Iamonico &Wilhalm 2008, Iamonico & Bovio 2010, Iamonico & Forbicioni 2011, Iamonico *et al.* 2010a−b, 2011, 2013, 2015, Iamonico & Calvia 2011, Iamonico & Del Guacchio 2011, Iamonico & Ferretti 2011, Iamonico & Sánchez Del-Pino 2012, Iamonico & Ardenghi 2013).

The aim of this work is to increase the knowledge of *Amaranthus* in Italy by a revision of the genus at national level, with the inclusion of morphological, ecological, chorological, and taxonomical observations and a diagnostic key.

Material and methods

The present study was based on personal field investigations in Italy during the period 2006−2014 [the specimens collected by the author are preserved in *Herbarium Iamonico* at HFLA], examination of exsiccata kept both in Italian and European Herbaria (AO, APP, AQUI, B, BI, BM, BOLO, BOZ, CAG, CAME, CAT, CLU, FI, G, GZU, K, LEC, LINN, LY, MPU, MRSN, MSMN, MSPC, P, PAD, PAL, PAV, PERU, PESA, PI, RO, ROV, S-LINN, TO, TR, TSB, URT, W, WU, Z), and in American ones (GH, MO, NY, PH, US) (acronyms according to Thiers 2014) plus the specimens preserved in the personal Herbaria (not listed in the Index Herbariorum) of A. Antonietti (Verbano-Cusio-Ossola), N. Ardenghi (Pavia), C. Argenti (Belluno), S. Ballelli (Camerino) M. Bovio (Aosta), G.V. Cerutti (Biella), E. Del Guacchio (Salerno), F. Giordana (Cremona), C. Lasen (Belluno), A. Soldano (Vercelli), A. Tisi (Alessandria), A. Truzzi (Mantova, Istituto Tecnico Agrario Statale Palidano). Relevant literature (protologues included) was also analyzed.

The following data are reported for each taxon:

- Accepted name following Mosyakin & Robertson (2003) except for *A. blitum* L. s.l. (Hügin 1987), *A. graecizans* L. (Costea 2003), *A. powellii* S.Watson, *A. bouchonii* Thell. and *A. cacciatoi* (Aellen ex Cacciato) Iamonico (Iamonico 2013d), and *A. tamariscinus* Nutt. (Iamonico 2010c);
- Synonyms refer to the names used in all comprehensive Italian floras and checklists (Bertoloni 1854, Arcangeli 1882, 1884, Caruel 1893, Cesati *et al.* 1884, Fiori & Paoletti 1898, Saccardo 1909, Fiori 1923, Zangheri 1976, Pignatti 1982, Conti *et al.* 2005, 2007, Celesti-Grapow *et al.* 2009a, 2009b, 2010);
- Types;
- Description based on personal observations (descriptions of floral bracts and ratio fruit/perianth refer to the pistillate flowers);
- Iconography (literature references that represent good images for each taxon[1]) and original photos;
- Phenology;
- Habitat;
- Elevation;
- Chromosome number. No countings from Italian plants are available (Bedini *et al.* 2010 onwards, 2012). If the countings were obtained from European populations, also the country is indicated;
- Alien status (only for the exotic taxa) according to Pyšek *et al.* (2004), Richardson & Pyšek (2006), and Ricciardi & Cohen (2007). The status of naturalization, native range, residence time (archaeophyte/neophyte), impact type (for invasive and naturalized taxa) are indicated, both at national and regional level. It was

1. The ongoing study on *Amaranthus* reveals that several published images show wrong interpretation of the taxa circumscriptions. Therefore, we strongly suggest to consider only the iconographies cited in the present work, since these surely refer to the correct species circumscription.

assigned on the basis of the highest stage in the invasion process documented in any region. This means that the taxa were considered to be naturalized for Italy when they are naturalized in at least one region. Similarly, I defined a taxon as invasive in Italy, when it is invasive in at least one region;

– Chorology (only for the native taxa);
– Occurence in Italy, providing the distribution at regional level. The regional occurrences are based on Celesti-Grapow *et al.* (2010); subsequent records are indicated for each taxon and regions. The region names abbreviations according to Conti *et al.* (2005), and are listed on the basis of the following geographical criterion: northern regions (from west to east), central and sounthern regions (from north to south), Sicily and Sardinia. Acronyms and region names are:
  · VDA (Valle d'Aosta),
  · PIE (Pemonte),
  · LOM (Lombardia),
  · TAA (Trentino-Alto Adige),
  · VEN (Veneto),
  · FVG (Friuli-Venezia Giulia),
  · LIG (Liguria),
  · EMR (Emilia-Romagna),
  · TOS (Toscana),
  · MAR (Marche),
  · UMB (Umbria),
  · LAZ (Lazio),
  · ABR (Abruzzo),
  · MOL (Molise),
  · CAM (Campania),
  · BAS (Basilicata),
  · PUG (Puglia),
  · CAL (Calabria),
  · SIC (Sicilia),
  · SAR (Sardegna).
– Taxonomic annotations (if necessary), including descriptions and keys for the identification of accepted infraspecific taxa;
– Specimina Visa Selecta, listed in chronological order for each cited administrative region (a selection of the over 3,000 specimens examined).

General remarks on the inflorescence morphology and terminology

The structure of the inflorescence in the *Amaranthaceae* is very complex (Acosta *et al.* 2009). Concerning *Amaranthus*, it is a synflorescence of thyrsoid paracladia. The basic structure of each synflorescence comprises a distal leafless region (Ts = terminal synflorescence), and a proximal leafy region (As = axillary synflorescence), but, in some cases, one of the two main regions is lacking (the As region sometimes lacks in the subgenera *Acnida* and *Amaranthus*, while the Ts region often lacks in the subgenus *Albersia*). Both the Ts and the As regions can develop sessile or petioled branches [Pc = paraclades of first order (AsPc and TsPc, respectively)]; in this case, the terminal flowering grouping on the main axis will be named "Main florescence" (= Mf) according to Acosta *et al.* (2009) (Fig. 1A−B). Each paraclade can be simple or branched [Pc′ = paraclades of second order (AsPc′ and TsPc′)]. A third order of paraclade (AsPc′′ and TsPc′′) can be observed, especially in the Ts region. The structure of the branched paraclades is similar to that described for the main axes.

The flowering unit (= Fu) is a dichasial cyme, often compound owing to the development of the axillary bud of the prophylls of the lateral flowers of different order. The basic pattern of the Fu consists of a florescence that bears three (Fig. 2A) or more fertile flowers (Fig. 2B). However, the cymose branching may repeat itself from the axillary bud in each flowering axis, so the partial florescences (cymes) may show a complex structure. The terminal Fu (named tFu) of the main axis corresponds to the Mf, the lateral Fu is called aFu (see Fig. 1A−B).

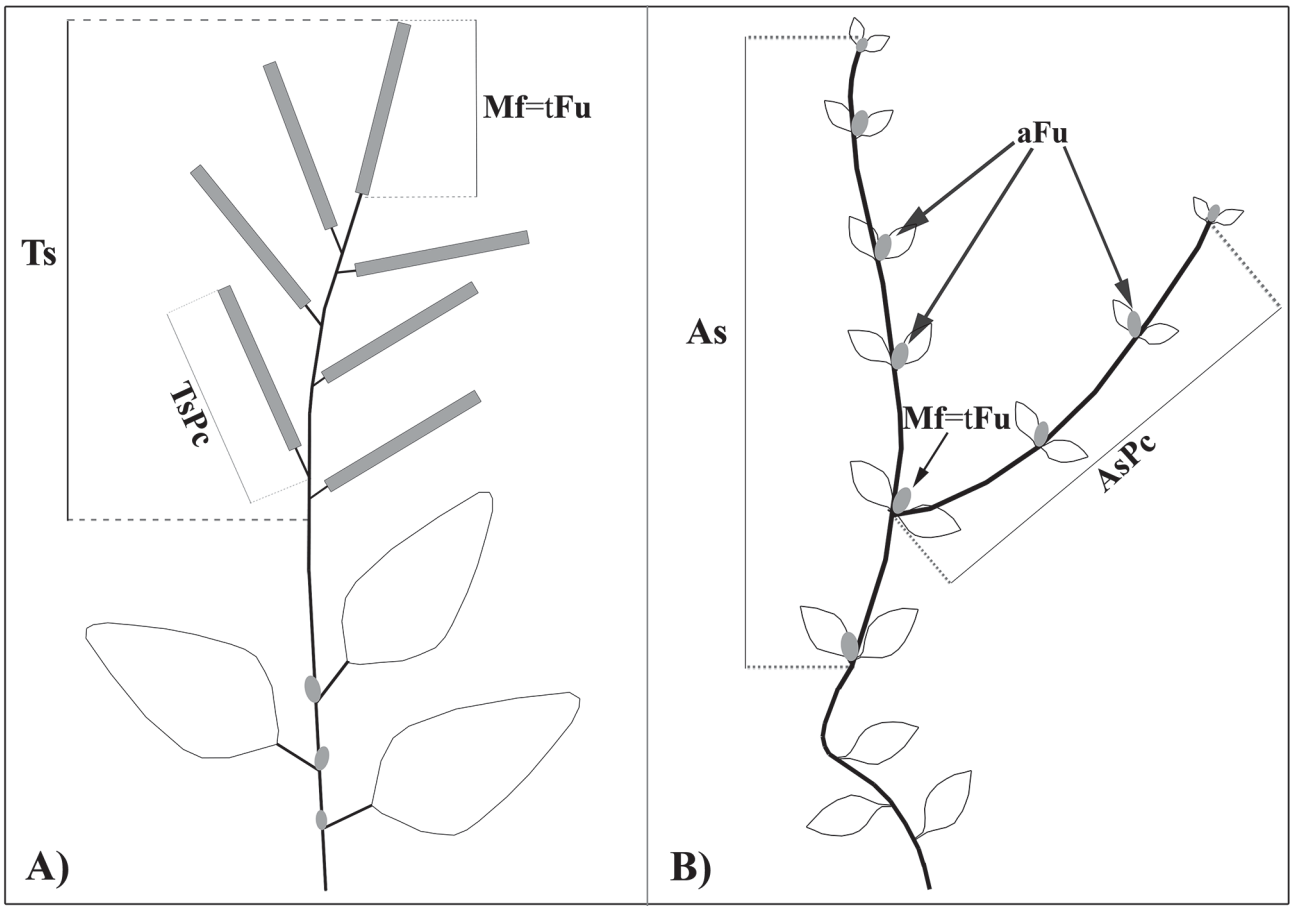

FIGURE 1. Synflorescence in *Amaranthus*: **A**. Subgenus *Amaranthus*, **B**. Subgenus *Albersia* (without terminal florescence). Ts = Terminal synflorescence; As = Axillary synflorescence; TsPc = Paraclade of terminal synflorescence; AsPc = Paraclade of axillary synflorescence; Mf = Main florescence; Fu = Flowering unit; tFu = Terminal flowering unit.

The flowers are unisexual. The pistillate flowers (Fig. 2A−B) are composed of 1−5 equal or unequal tepals (actinomorhic or zygomorphic flowers) (sometimes the perianth is lacking) usually free (in *A. polygonoides* L. the tepals are connate in the proximal ⅓) and subtended by 2−5 bracts [in *A. spinosus* L. bracts of the first flower in the first cyme (whose development is early suppressed in the ontogeny) is metamorphosed into a spine-like structure (Costea & Tardif 2003a)]. The tepals (in pistillate flowers) are very variable in shape (from linear to ovate, sometimes spathulate). Concerning the bracts, their apex can be truncate, obtuse, or acute, sometimens mucronate or awned (while awns do not occur in the tepals). Each bract has membranous usually hyaline borders that in the subgenus *Amaranthus* can be thinning to the apex or abruptly interrupted about at the half of the total length of the bract; the median vein can be prominent (keeled bract) or not (sometimes the midrib is not visible). One pistil, one ovule, style sometimes absent, stigmas 2−5, slender. The staminate flowers have 3−5 equal or subequal and free tepals (actinomorphic flowers), subtended by 3−5 bracts; stamens are 3−5, filaments with distinct filaments, and 4-locular anthers.

The result of this complex synflorescence is a spike- or panicle-like inflorescence and/or an axillary glomerule arrangement.

Plants can be dioecious (subgenus *Acnida*) or monoecious (subgenus *Albersia* and subgenus *Amaranthus*).

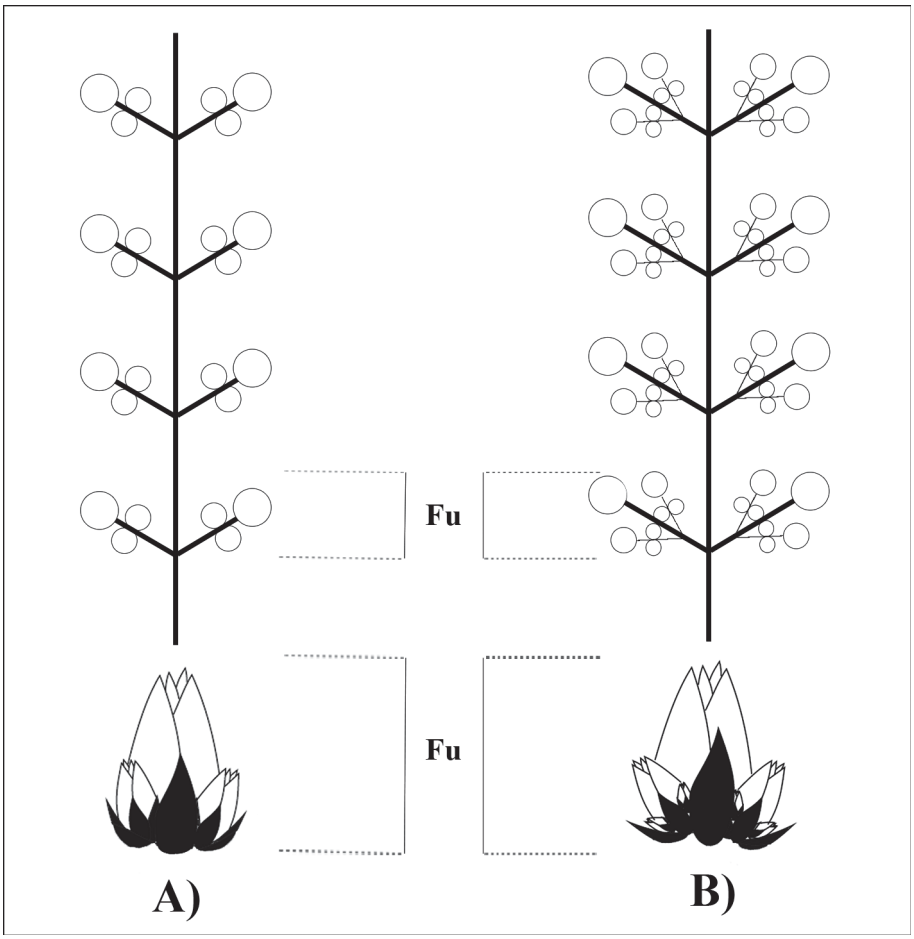

FIGURE 2. Synflorescence in *Amaranthus*: **A**. Florescence bearing three fertile flowers, **B**. Florescence bearing more than three fertile flowers. Fu = Flowering unit. Each white circle represents one flower (the two upper images). Bracts and tepals (the lower two magnified Fu) are respectively in black, and white.

Taxonomic treatment

Amaranthus L., Sp. Pl. 2: 989. 1753.

Type (lectotype designated by Green 1929: 188): *Amaranthus caudatus* L.

Description:—Monoecious or dioecious herbs, usually annual (therophytes), rarely perennial (hemicryptophytes). Stems erect, ascending, prostrate or diffuse, glabrous to tomentose (trichomes uniseriate filiform, whitish to yellowish), white to red-brownish, often branched (sometimes simple). Leaves alternate, petiolated, with blade linear to ovate, elliptic to deltoid to rhombic; base cuneate to obtuse; apex acute, obtuse, emarginate or bilobe, sometimens mucronate; margins entire, sometimens undulate; blade glabrous to pubescent (sometimens only on the veins), with trichomes whitish to yellowish, uniseriate, filiform. Synflorescences thyrsoid paraclades arranged in terminal and/or axillary spike- or panicle-like inflorescences or only in axillary glomerules. Bracts 1−5, ovate to lanceolate, with membranous border thinning to apex or abruptly interrupted at the half of the total length, sometimes keeled; apex acute to obtuse. Flowers unisexual, sessile. Staminate flowers with 3−5 free and equal tepals, ovate to lanceolate, usually glabrous; apex usually acute; margin entire; stamens 3−5, anthers tetrasporangiate with 2 lines of dehiscence, filaments free to the base; pseudostaminodia absent. Pistillate flowers with (0−)2−5 usually free tepals, linear to ovate-lanceolate sometimes spathulate, usually glabrous; apex acute to emarginate (sometimes mucronate); margins entire; one pistil, one ovule, 2−5 stigmas. Fruit dry (dehiscent capsule,

or indehiscent utricle), globose to ellipsoid, smooth to strongly rugose on the surface, with often persistent styles; seed one, usually lenticular, smooth to reticulate; embryo annular.

Historical background:—The genus *Amaranthus* was first described by Linnaeus (1753: 989) as consisting of 11 species, 6 of which were included in the group "*Triandri*", 5 in the group "*Pentandri*" (now respectively corresponding to the subgenera *Albersia* and *Amaranthus*). Subsequenlty, Linnaeus (1755, 1759a–b, 1763, 1771) published 12 other species, for a total of 23 taxa. The Linnaean generic concept corresponds with the current one, but the species delimitation strongly changed over time due to misapplication of names. Concerning Italy, a concise historical background is presented in Table 1.

General note:—Twenty-seven non-hybrid taxa (twenty-four species), including six varieties were here recorded in Italy. Three taxa [*A. blitum* var. *blitum*, *A. cacciatoi*, and *A. graecizans* subsp. *sylvestris* (Vill.) Brenan] are authoctonous, while the others are to be considered aliens, mostly neophytes native to the Americas (Table 2). The occurrence of *A. crassipes* Schltdl. and *A. graecizans* s.s. remain doubtful [*A. crassipes* is excluded from the following diagnostic key, and added at the end of the manuscript (see "*Doubtful species*"), while *A. graecizans* subsp. *graecizans* is also discussed under *A. graecizans* s.l.].

The characters of the flowers refer to the pistillate ones, since the features of the staminate flowers have a very low taxonomical value in the genus *Amaranthus*.

1. Plant dioecious (I. subgenus *Acnida*) 2
- Plant monoecious 4
2. Tepals 5 ..... 1. *A. palmeri*
- Tepal absent or reduced to 1−2 3
3. Tepals absent (sometimes a single tepal ≤ 1.5 mm long) ..... 2. *A. tuberculatus*
- Tepals 2, one of them ≤ 1 mm long ..... 3. *A. tamariscinus*
4. Tepals (2−)3(−5) (2 tepals in *A. deflexus*; 4−5 in *A. blitoides* and *A. acutilobus*); prostrate, ascending or erect plants; synflorescence usually arranged in axillary glomerules (spike-like synflorescence in *A. deflexus, A. emarginatus s.l.*, *A. tricolor, A. viridis*, and *A. blitum*) (when plants are erect and/or or the synflorescence is spike-like, tepals are 2−3); fruit dehiscent or indehiscent (II. subgenus *Albersia*) 5
4. Tepals 5; erect plants; synynflorescence spike- or panicle-like; fruit usually dehiscent (but indehiscent in *A. bouchonii*) (III. subgenus *Amaranthus*) 18
5. Tepals 2 ..... 4. *A. deflexus*
- Tepals > 2 6
6. Tepals 3 7
6. Tepals > 3 14
7. Stem white to white-greenish; bracts spinescent ..... 5. *A. albus*
- Stem never white to white-greenish; bracts not spinescent 8
8. Synflorescence spike- or panicle-like 9
- Synflorescence in axillary glomerules 12
9. Fruit strongly rugose on the surface, subglobose, indehiscent; stem erect ..... 6. *A. viridis*
- Fruit smooth or sligthly rugose, ellipsoidal or subglobose, dehiscent or indehiscent; stem, erect, ascending or prostrate 10
10. Fruit dehiscent (capsule) shorter than the perianth; stem erect ..... 7. *A. tricolor*
- Fruit indehiscent (utricle), longer than the perianth; stem prostrate or ascending 11
11. Utricle pear-shaped, 2 time longer than the perianth ..... 4. *A. deflexus*
- Utricle subglobose or ellispoidal (in this case up to 1.5 times longer than the perianth ..... 8−9. *A. blitum* aggregate[1]
12. Leaf apex emarginate to bilobe ..... 9. *A. emarginatus* s.s.
- Leaf apex acute (sometimes obtuse in *A. graecizans*, but never bilobe) 13
13. Fruit shorter than the perianth ..... 7. *A. tricolor*
- Fruit as long as or longer than the perianth ..... 10. *A. graecizans* s.l.
14 Tepals usually 4; leaf blade with marginal white vein ..... 11. *A. blitoides*
- Tepals 4−5; leaf blade without marginal white vein 15
15. Tepals 4 (rarely 5); bracts longer than the perianth; leaf apex deeply bilobe (apical sinus ¼-⅓ times the blade length) ..... 12. *A. acutilobus*
- Tepals 5; bracts shorter than the perianth; leaf apex acute, obtuse or emarginate, but never bilobe (apical sinus $^{1}/_{20}$-$^{1}/_{30}$ times the blade length) 16
16. Perennial plants; leaf blade linear or linear-lanceolate ..... 13. *A. muricatus*
- Annual plants; leaf blade ovate or lanceolate 17

1. See pag. 26 for the detailed diagnostic key.

TABLE 1. Historical background of the *Amaranthus* names in the Italian floras.

Bertoloni (1854)	Caruel (1893)	Arcangeli (1882, 1884[1])	Fiori & Paoletti (1898)	Fiori (1923)
-	-	-	-	*A. acutilobus*
A. albus	*A. albus*	*A. albus*	*A. albus*	*A. albus*
-	-	-	-	-
A. blitum, *A. ascendens*	*A. blitum*, *A. ascendens*	*A. blitum*, *A. viridis*	-	*A. ascendens*
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	*A. caudatus*	*A. caudatus*
-	-	-	-	*A. crassipes*
-	-	-	-	*A. crispus*
A. patulus	*A. patulus*	*A. patulus*	*A. paniculatus* b. *cruentus*, *A. paniculatus* c. *sanguineus*, *A. retroflexus* var. *patulus*	*A. hybridus* var. *patulus*, *A. hybridus* var. *paniculatus*, *A. hybridus* var. *cruentus*
A. prostratus	*A. prostratus*	*A. deflexus*	-	*A. deflexus*
-	-	-	*A. graecizans*	*A. graecizans* α *typicus*
-	-	-	*A. graecizans* b. *sylvester*	*A. graecizans* β *sylvester*
-	-	-	*A. retroflexus* var. *chlorostachys*	*A. hybridus* var. *chlorostachys*
-	-	-	*A. hypochondriacus*	*A. hybridus var. hypochondriacus*
-	-	-	-	-
-	-	-	-	-
-	-	-	*A. polygonoides*	*A. polygonoides*
-	-	-	-	-
-	-	-	-	-
A. retroflexus	*A. retroflexus*	*A. retroflexus*	*A. retroflexus* var. *typicus*	*A. retroflexus* var. *typicus*, *A. retroflexus* var. *delilei*
-	-	*A. spinosus*	*A. spinosus*	*A. spinosus*
-	-	-		-
-	-	-	*A. tricolor* α *typicus*, *A. tricolor* α *typicus* b. *melancholicus*	*A. tricolor* α *typicus*, *A. tricolor* β *tristis*, *A. tricolor* γ *mangostanus*
-	-	-	-	-
-	-	-	-	-

…… *to be continued on the next page*

[1] Arcangeli (1884) provided the same list as Arcangeli (1882), except for the addition *A. spinosus*.

TABLE 1 (Continued)

Zangheri (1976)	Pignatti (1982)	Conti *et al.* (2005)	Celesti-Grapow *et al.* (2009a)	Iamonico (present study)
-	-	*A. acutilobus*	*A. acutilobus*	*A. acutilobus*
A. albus	*A. albus*	*A. albus*	*A. albus*	*A. albus*
A. blitoides	*A. blitoides*	*A. blitoides*	*A. blitoides*	*A. blitoides*
A. lividus	*A. lividus*	*A. blitum* subsp. *blitum*	-	*A. blitum* subsp. *blitum* var. *blitum*
-	-	-	-	*A. blitum* subsp. *blitum* var. *oleraceus*
-	-	-	-	*A. emarginatus* subsp. *emarginatus* var. *emarginatus*
-	-	-	-	*A. emarginatus* subsp. *emarginatus* var. *pseudogracilis*
-	*A. bouchonii* var. *cacciatoi*			*A. cacciatoi*
A. caudatus	*A. caudatus*	*A. caudatus*	*A. caudatus*	*A. caudatus*
-	-	-	*A. crassipes*	*A. crassipes*
A. crispus	*A. crispus*	*A. crispus*	*A. crispus*	*A. crispus*
A. cruentus, *A. paniculatus*	*A. cruentus*, *A. paniculatus*	*A. cruentus*	*A. cruentus*	*A. cruentus*
A. deflexus	*A. deflexus*	*A. deflexus*	*A. deflexus*	*A. deflexus*
A. graecizans	*A. graecizans* var. *graecizans*	*A. graecizans*	*A. graecizans*	*A. graecizans* subsp. *graecizans*
	A. graecizans var. *sylvestris*		-	*A. graecizans* subsp. *sylvestris*
A. hybridus, *A. chlorostachys*	*A. chlorostachys*	*A. hybridus*	*A. hybridus*	*A. hybridus*
A. hypochondriacus	-	*A. hypochondriacus*	*A. hypochondriacus*	*A. hypochondriacus*
-	*A. muricatus*	*A. muricatus*	*A. muricatus*	*A. muricatus*
-	-	-	-	*A. palmeri*
A. polygonoides	*A. polygonoides*	*A. polygonoides*	*A. polygonoides*	*A. polygonoides*
-	-	*A. powellii*	*A. powellii*	*A. powellii*
A. bouchonii	*A. bouchonii*	*A. bouchonii*		*A. bouchonii*
A. retroflexus	*A. retroflexus* var. *Ttypicus*, *A. retroflexus* var. *delilei*	*A. retroflexus*	*A. retroflexus*	*A. retroflexus*
A. spinosus	*A. spinosus*	*A. spinosus*	*A. spinosus*	*A. spinosus*
-	-	*A. tamariscinus*	*A. tuberculatus*	*A. tamariscinus*
-	*A. tricolor*	*A. tricolor*	*A. tricolor*	*A. tricolor*
-	-	*A. rudis*	*A. tuberculatus*	*A. tuberculatus*
A. gracilis	*A. viridis*	*A. viridis*	*A. viridis*	*A. viridis*

TABLE 2. Synoptic list of the Italian *Amaranthus* taxa (accepted names, in alphabetical order), including data about: alien status, native range, status of naturalization (for the native or probably native/alloctonous taxa and doubtful species it is not reported and marked as "-"), preferential habitat, and economical impacts (highlighted by underlining the habitat; if no threats were observed the habitat is in normal font style). *A. crassipes* (see discussion at page 66) and the hybrids are not listed.

	Alien status	Native range	Status of naturalization	Preferential habitat
Amaranthus acutilobus	alloctonous	Central America	CAS	Human-made habitat
Amaranthus albus	alloctonous	North America	INV	Uncultivated and cultivated lands, roadsides, railways, backfills
Amaranthus blitoides	alloctonous	North America	INV	Cultivated fields, flowerbeds, uncultivated land, urban vegetable gardens, rubbles, roadsides, backfills
Amaranthus blitum* var. *blitum	native	Europe	-	Roadsides, river banks, cultivated lands
Amaranthus blitum* var. *oleraceus	alloctonous	Uncertain origin	CAS	Roadsides
Amaranthus bouchonii	probably native	probably Europe	-	Uncultivated land, roadsides, cultivated field, rubbles
Amaranthus cacciatoi	native	Endemic	-	Roadsides, uncultivated lands
Amaranthus caudatus	alloctonous	South America	CAS	Human-made habitats near gardens
Amaranthus crispus	alloctonous	South America	CAS	Roadsides, cultivated fields
Amaranthus cruentus	alloctonous	Central America	INV	Uncultivated land, roadsides
Amaranthus deflexus	alloctonous	South America	INV	Roadsides, flowerbeds, (foot of) walls, uncultivated lands
Amaranthus emarginatus* subsp. *emarginatus* var. *emarginatus	alloctonous	Tropical America	CAS	Roadsides, river banks
Amaranthus emarginatus* subsp. *emarginatus* var. *pseudogracilis	alloctonous	Tropical America	NAT	Roadsides, river banks
Amaranthus graecizans* subsp. *graecizans	probably alloctonous	Europe	-	Uncultivated land, roadsides, backfills
Amaranthus graecizans* subsp. *sylvestris	native	Europe	-	Uncultivated land, roadsides, backfills
Amaranthus hybridus	alloctonous	North and Central Americas	INV	Uncultivated land, roadsides, cultivated field
Amaranthus hypochondriacus	alloctonous	North America	CAS	Human-made habitats near gardens, but also in cultivated fileds and roadsides
Amaranthus muricatus	alloctonous	South America	INV	Roadsides, ruderal habitats, walls
Amaranthus palmeri	alloctonous	North America	CAS	Uncultivated lands along roadsides
Amaranthus polygonoides	alloctonous	South America	CAS	Uncultivated land, roadsides
Amaranthus powellii	alloctonous	North and South America	INV	Uncultivated land, roadsides, cultivated field, rubbles
Amaranthus retroflexus	alloctonous	North America	INV	Roadsides, flowerbeds, uncultivated land, cultivated fields, railways, backfills, rubbles
Amaranthus spinosus	alloctonous	Neotropics	CAS	River banks
Amaranthus tamariscinus	alloctonous	North America	CAS	Uncultivated land
Amaranthus tuberculatus	alloctonous	North America	INV	River banks, uncultivated land
Amaranthus tricolor	alloctonous	Tropical Asia	CAS	Human-made habitats near gardens
Amaranthus viridis	alloctonous	South America	INV	Flowerbeds, roadsides, railways, uncultivated land

17. Leaf blade margin crispate; tepals obovate-spathulate, free ..... 14. *A. crispus*
- Leaf blade margin not crispate; tepals linear-spathulate, connate in the proximal ⅓ ..... 15. *A. polygonoides*
18. Terminal synflorescence pendulous up to 70 cm long ..... 16. *A. caudatus*
- Terminal synflorescence erect, shorter 19
19. Bracts of the first flower in the first cyme metamorphosed into a spine-like structure ..... 17. *A. spinosus*
- Bracts spine-like absent 20
20. Stem and/or leaves pubescent to tomentose; main florescence usually as long as or shorter than the paraclades; tepals spathulate, obtuse or emarginate, as long as or longer than the stigmas ..... 18. *A. retroflexus*
- Stem and/or leaves ± glabrous (sometimes stem pubescent especially in the distal synflorescence region, Ts); main florescence always longer than the paraclades; tepals with acute apex, not emarginate, shorter than the stigmas ..... 19–24. *A. hybridus* aggregate[1]

I. *Amaranthus* subgenus *Acnida* (L.) Aellen ex K.R.Robertson, J. Arnold Arbor. 62(3): 283. 1981. Basionym: *Acnida* L., Sp. Pl. 2: 1027. 1753.

Type (holotype in Linnaeus 1753: 1027): *Acnida cannabina* L.
≡ *Amaranthus* subgenus *Acnida* (L.) Aellen in Hegi, Ill. Fl. Mitt.-Eur. 3(2): 467, 474. 1959, *nom. inval.*, Art. 41.5 of the ICN (McNeill *et al.* 2012).

Note:—*Acnida* was treated as a separate genus until 1955, when Sauer (1955) thoroughly discussed its inclusion in *Amaranthus*. However, he did not propose any nomenclatural combination for the dioecious amarants. Aellen (1959) proposed *Amaranthus* subgenus *Acnida* (L.) Aellen but this combination is not valid, since the author did not cite the basionym (Art. 41.5 of the ICN). Robertson (1981: 283) later validated the combination. According to Mosyakin & Robertson (1996) three sections can be recognized on the basis of characters referring to the fruit (dehishent/indehishent), bracts (foliaceous or not), and tepal number (0−2, or 5): sect. *Acnida* (L) Mosyakin & K.R.Robertson, sect. *Saueranthus* Mosyakin & K.R.Robertson, and sect. *Acanthochiton* (Torr.) Mosyakin & K.R.Robertson. Concerning Italy, two sections occur: sect. *Acnida* with 2 species, and sect. *Saueranthus* with 1 species.

1. *Amaranthus palmeri*[2] S.Watson, Proc. Amer. Acad. Arts. 12: 274. 1877 (Fig. 3).

Type (lectotype designated by Sauer 1955: 31):—U.S.A. California: banks of Rio Grande, July 1834, *Berlandier 2407* (GH!).

Description:—Herbs 5–20 dm tall, dioecious, annual (therophyte). Stems erect, glabrous or nearly so, green or reddish, branched. Leaves green, the lower ones ovate, rhomboidal (1.5–7.0 × 1.0–3.5 cm), the upper leaves lanceolate, glabrous, margins entire, apex obtuse to acute, mucronulate, base broadly cuneate, petioled (petiole 0.5–3.5 cm long). Synflorescences terminal, spike- or panicle-like type, drooping or erect, often interrupted in the proximal part, green, the main florescence up to 25 cm long. Floral bracts 1, usually ligth green, lanceolate [(0.5−)1.0–2.5(−3.0) × 4.0−6.0 mm], 2−2.5 longer than the perianth, sometimes carinate, apex acuminate, margin entire, glabrous. Staminate flowers with 5 unequal tepals, lanceolate (2.0–4.0 × 0.5–1.5 mm), apex acute, awned (especially the inner tepals); stamens 5. Pistillate flowers with 5 tepals, obovate-spathulate [(1.5–)1.7–3.8(–4.0) × 0.4–0.6 mm]; style branches spreading, stigmas 2(–3). Fruit usually brown, subglobose or ellipsoidal (1.5–2.0 × 1.0–2.0 mm), shorter than the perianth, usually smooth, dehiscent. Seed lenticular [(1.0–1.2) mm in diameter], dark-reddish to brown.

Iconography:—Mosyakin & Robertson (2003).
Phenology:—Flowering from September to October.
Habitat:—Uncultivated land along roads.
Elevation:—0–10 m a.s.l.

1. See pag. 52–53 for the detailed diagnostic key.
2. Edward Palmer (1831–1911), American botanist.

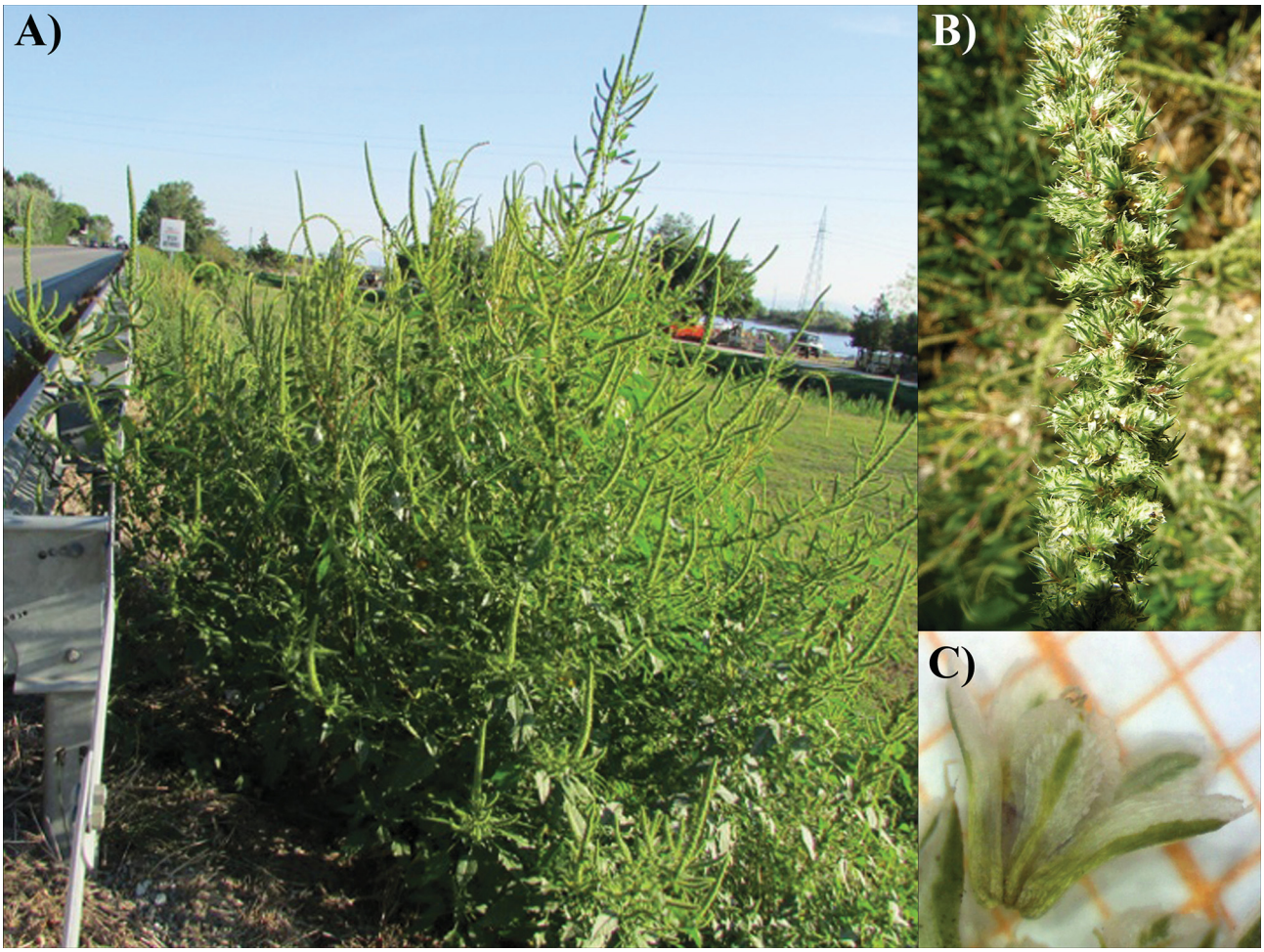

FIGURE 3. *Amaranthus palmeri* (Emilia-Romagna, Ravenna province, Cervia locality, uncultivated lads along roadsides): **A)** individual, **B)** synflorescence, **C)** detail of flowers (photos by G. Faggi).

Chromosome number:—2n = 34 (Reveal & Spellenberg 1976).

Alien status:—Neophyte species native to North America, it can be considered casual in Italy.

Occurrence in Italy:—Recently discovered in EMR (Northern Italy) where is casual alien (Iamonico & al. 2015).

Taxonomic annotations:—*Amaranthus palmeri* is the only italian dioecious species belonging the the sect. *Saueranthus* being characterized in having the pistillate flowers with 5 tepals. The related species is *A. watsonii* Sandl. that differs from *A. palmeri* in having the stem glandular, and the bracts shorter.

Specimina Visa Selecta:—ITALY. **Emilia-Romagna**: Cervia, via Romea Nord (SS16), 2 m a.s.l, road embankment with ruderal vegetation, 8 October 2014, *Faggi, Iamonico & Ardenghi s.n.* (HFLA! five sheets).

2. *Amaranthus tuberculatus* (Moq.) J.D.Sauer, Madroño 13: 18. 1955 (Fig. 4).

Basionym: *Acnida tuberculata* Moq., Prodr. [A. P. de Candolle] 13(2): 277. 1849.≡ *Acnida tamariscina* (Nutt.) Alph.Wood var. *tuberculata* (Moq.) Uline & Bray, Bot. Gaz. 20: 157. 1895.

Type (lectotype designated by Iamonico 2015):—SWITZERLAND. Genève, *Hort. Genève*, September 1847, *Reuter s.n.* (G-221914/1!, and G-221914/2!). The two sheets bear male and female individuals, respectively, and can be considered as part of the same gathering (Art. 9.17 of the ICN).

= *Amaranthus rudis* J.D.Sauer, Madroño 21: 428. 1972.

Type:—U.S.A. Kansas: Riley Co., 6 August 1895, *Norton 428* (holotype, MO!; isotypes, GH!, US!).

Description:—Herbs 10–20 dm tall, dioecious, annual (therophyte). Stems erect or ascending, glabrous, often reddish, branched. Leaves green to reddish, ovate to lanceolate-linear [(1.5–)2.0–12.0(–15.0) × (0.5–)0.8–2.5(–3.0)

cm], with entire margins, apex obtuse or retuse, mucronulate, base cuneate, glabrous, petioled (petiole 0.5–5.0 cm long). Synflorescences terminal, spike- or panicle-like type (sometimes interrupted-moniliform), erect, usually reddish, the main florescence up to 50 cm long. Floral bracts 1, green to reddish, lanceolate [(0.5−)0.8–2.5(−2.8) × 0.4−1.1(–1.9) mm], as long as or slightly longer than the perianth, sometimes carinate, apex acuminate, margin entire, glabrous. Staminate flowers with 5 tepals, ovate to lanceolate [(1.7−)1.8–3.0(−3.5) × 0.5–1.1(−1.4) mm], apex obtuse or acute, awned (especially the inner tepals); stamens 5. Pistillate flowers without tepals or with only one reduced lanceolate to linear tepal (up to 1.5 mm long); style branches ± erect, stigmas 3. Fruit dark-brown to reddish, subglobose or ellipsoidal [(0.9–)1.2–1.9(–2.3) × 0.9–1.5 mm], as long as or slightly shorter than the perianth, usually smooth, dehiscent. Seed lenticular [0.6–1.0(–1.2) mm in diameter], black or reddish-brown.

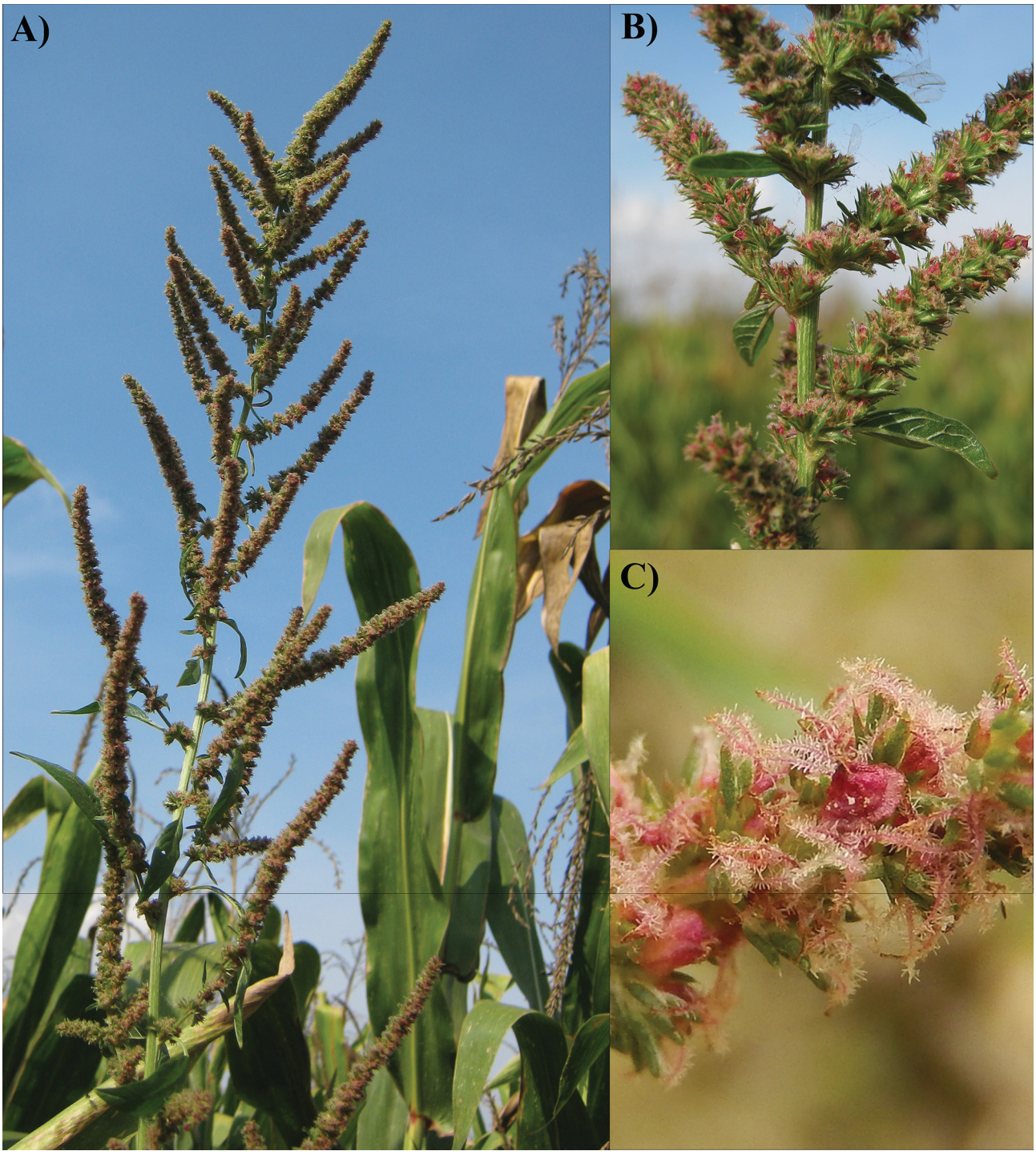

FIGURE 4. *Amaranthus tuberculatus* (Lombardia, Pavia province, Stradella locality, corn crop): **A)** individual, **B)** synflorescence, **C)** detail of flowers (photos by N. Ardenghi)

Iconography:—Mosyakin & Robertson (2003), Costea *et al.* (2005: 510, figure 2a−d).

Phenology:—Flowering from September to October.

Habitat:—Mainly on the river banks, rarely in uncultivated land or human-made habitats (Alessandrini 2010, Iamonico 2011, 2012c).

Elevation:—0–200 m a.s.l.

Chromosome number:—2n = 32 (Trucco *et al.* 2006).

Alien status:—Neophyte species native to North America, it can be considered invasive in Italy, causing threats on the native riparian herbaceous vegetation.

Occurrence in Italy:—Northern Italy, mainly in the surroundings of the Po river area [invasive in LOM, and EMR, naturalized in VEN (see also Masin & Scortegagna 2012), casual in TAA (Bertolli & Prosser 2014), PIE, and FVG], and Central Italy [naturalized in TOS [La Rosa & Peruzzi 2013 (swamp "Fucecchio", Pistoia province), Lazzeri & al. 2013 (banks of the Arno river, Pisa city)] and MAR (banks of the Metauro river)].

Taxonomic annotations:**—**Morphological differences based on plant high, branching pattern, stem colour, shape and length of the cotyledons and mature leaves, number of the tepals and dehiscence/indehiscence of the fruit were interpreted recognizing two separate species: *A. tuberculatus* and *A. rudis*. A detailed study by Pratt & Clark (2001) showed a *continuum* in the variability of these characters, which led the authors to synonymize these names. Two years later Costea & Tardif (2003b) proposed the varietal rank for *A. rudis*. The opinion of Pratt & Clark (l.c.) is here followed.

Specimina Visa Selecta:—ITALY. **Emilia-Romagna**: Castel San Giovanni (Piacenza), sponda del Po, 1 October 1981, *Soldano s.n.* (HFLA!); Modena, quartiere Sacca, rudereti, *Alessandrini s.n.* (HFLA!); golena del Po tra ponte lagoscuro e Ravalle (Ferrara), 16 August 2006, *Pellizzari 3481* (FER!). **Marche**: Fossombrone, alveo del fiume Metauro, 2006, *Gubellini & Pinzi s.n.* (PESA!). **Lombardia**: Castelnuovo nella riva sinistra del Po, spiazzone di sabbie asciutte, 5 September 1974, *Cacciato s.n.* (RO!); Mantova, Riva di Suzzara, golena del Po, 21 September 1992, *Truzzi 44 bis* (*Herb. Truzzi*!); Mantova, Borgoforte, alveo asciutto del Po, 31 August 1993, *Truzzi 83* (*Herb. Truzzi*!); *ibidem*, 15 September 2002, *Truzzi 283* (*Herb. Truzzi*!). **Toscana**: Pistoia, Larciano, area del Padule di Fucecchio, loc. Le Morette, 15 m a.s.l., 10 August 2004, *La Rosa s.n.* (FI!). **Veneto**: Belluno, Lambioi di Belluno, incolti, individuo femminile, 340 m s.l.m., 8 September 2000, *Argenti 9839/3* (*Herb. Argenti*!); *ibidem*, male individual (*Herb. Argenti*!).

3. *Amaranthus tamariscinus* Nutt., Trans. Amer. Philos. Soc. ser. 2, 5: 165. 1835 (Fig. 5).

≡ *Montelia tamariscina* (Nutt.) A.Gray, Manual (Gray), ed. 2. 370. 1856.

≡ *Acnida tamariscina* (Nutt.) Alph.Wood, Amer. Bot. Fl. 289. 1870.

Type (lectotype designated by Iamonico 2015):—U.S.A. Arkansas, *Nuttall s.n.* (BM-000080759!, isolectotypes: PH-00002355! NY-00277924!).

Description:—Herbs (4–)6–8 dm tall, dioecious, annual (therophyte). Stems erect or ascending, glabrous, usually green, branched. Leaves green to reddish, ovate to lanceolate [(2.0–)2.5–10.0 × 0.4–3.5 cm], with entire margins, apex obtuse or retuse, mucronulate, base cuneate, glabrous, petioled (petiole about as long as the blade). Synflorescences terminal, panicle-like type, lax, green or sometimes reddish, the main florescence more than 10 cm long. Floral bracts 1, greenish, lanceolate (1.0–2.5 × 0.5−1.0 mm), as long as or slightly longer than the perianth, apex aristate, margin entire, glabrous. Flowers often sterile. Staminate flowers with 5 tepals, ovate to lanceolate, with apex acute, awned; stamens 5. Pistillate flowers with 2 tepals, of which 1 reduced, lanceolate; stigmas 3. Fruit brown-yellowish, subglobose or ellipsoidal [0.9–1.9(–2.3) × 0.9–1.5 mm] as long as or slightly shorter than the perianth, indehiscent. Seed lenticular [0.6–1.2(–1.4) mm in diameter], black.

Iconography:**—**Britton & Brown (1913: 6).

Phenology:**—**Flowering from September to October.

Habitat:**—**Uncultivated land (Iamonico 2010c).

Elevation:**—**0–100 m a.s.l.

Chromosome number:**—**Unknown.

Alien status:**—**Neophyte species native to North America, it can be considered casual alien in Italy.

Occurrence in Italy:**—**Northern Italy (FVG), in the localities Pieris and Monfalcone (Melzer & Bregant 1990, Iamonico 2010c).

FIGURE 5. *Amaranthus tamariscinus*: the only extant Italian exsiccatum [Friuli-Venezia Giulia, Monfalcone locality (GZU)]: **A)** female individual, **B)** male individual.

Taxonomic annotations:—*A. tamariscinus* was considered synonym of *A. tuberculatus* by some authors (e.g., Celesti-Grapow *et al.* 2009a, 2009b, 2010). On the basis of the examination of Nuttall's collection, Sauer (1972: 426–434) stated that the name *A. tamariscinus* is to be referred to a sterile hybrid between *A. tuberculatus* and a monoecious taxon, possibly *A. hybridus*. Recently, Iamonico (2010c), clarified the identity of *A. tamariscinus*, confirming the hybrid origin and its occurrence in Italy.

Specimina Visa Selecta:—ITALY**. Friuli-Venezia Giulia**: auf Anschüttungen östlich des Hafens von Monfalcone, 13 September 1989, *Melzer s.n.* (GZU!); *ibidem*, 15 September 1989 (GZU!).

II. *Amaranthus* subgenus *Albersia* (Kunth) Gren. & Godr., Fl. France. 3: 3. 1855.

Basionym: *Albersia* Kunth, Fl. Berol. 2: 144. 1838.
Type (holotype in Kunth 1838: 144): *Albersia blitum* (L.) Kunth.

Note:—*Albersia* was established by Kunth (1838: 144) to accommodate the *Amaranthus* species with indehiscent fruits. However, the study by Mosyakin & Robertson (1996) showed that the fruit characters only cannot be used to segregate infrageneric taxa, and that perianth features also must be considered. So, the authors recognized four sections: sect. *Blitopsis* Dumort., sect. *Pentamorion* (Beck) Mosyakin & K.R.Robertson, sect. *Goerziella* (Urban) Mosyakin & K.R.Robertson, and sect. *Pyxidium* Moq. I here provisionally accept the classification proposed by Mosyakin & Robertson (1996), highlighting that subgenus *Albersia* could be reclassified through the recognition of several narrowed and more natural sections and subsections as suggested by Mosyakin & Robertson (1996). Concernig Italy, three sections (and 11 species) occur according to Mosyakin & Robertson (1996), the Cuban endemic sect. *Goerziella* being excluded. However, for the present study I prefer to avoid this classification scheme, since a new study on the infrageneric classification is currently in progress (D. Iamonico in preparation).

4. *Amaranthus deflexus* L., Mant. Pl. Altera: 295. 1771 (Fig. 6).

≡ *Euxolus deflexus* (L.) Raf., Fl. Tellur. 3: 42. 1837.
≡ *Albersia deflexa* (L.) Fourr., Ann. Soc. Linn. Lyon sér. 2, 17: 142. 1869.
Type (lectotype designated by Aellen 1972: 7):—UNKNOWN ORIGIN. *Herb. Linn. No. 1117.18* (LINN!).
= *Amaranthus prostratus* Bellardi ex Balb., Misc. Bot. 44. 1803.

Type (lectotype designated by Iamonico 2015):—[Icon] Tab. 10 from Balbis (1804).

Description:—Herbs (1–)2–6(–9) dm tall, monoecious, perennial (hemicryptophyte), rarely annual (therophyte). Stems ascending or prostrate, ± glabrous (slightly pubescent in the upper part), light brown to reddish (sometimes green), branched. Leaves usually green (sometimes with a central white or dark-red spot), ovate or lanceolate, deltoid [(1.5–)2.0–5.0(–7.0) × 0.5–2.5(–3.5) cm], with entire margins, apex obtuse, base cuneate, glabrous (sometimes pubescent on the veins), petioled (petiole 0.7–3.5 cm long). Synflorescences in axillary glomerules and terminal spike-like type, erect or slightly recurved, green or brown-reddish, 2.0–10.0(–13.0) cm long. Floral bracts, green to brownish, ovate to linear [(0.4−)0.5–1.2 × 0.4−0.6 mm], ⅓−½ times shorter than the perianth, mucronate, margin entire, glabrous. Staminate flowers with 2−3 tepals, usually ovate; stamens 2−3. Pistillate flowers with 2 (rarely 3) tepals, linear to lanceolate [(1.2−)1.5–2.5 × 0.3–0.4 mm]; stigmas 3. Fruit pale brown to yellowish-brown, ellipsoidal-pear-shaped [(2.0–)2.5–3.0 × 1.0–1.5 mm], two times longer than the perianth, smooth, indehiscent. Seed lenticular-ovoid (1.0–1.2 × 0.7–0.9 mm in diameter), black or dark-brown.

Iconography:—Beck (1909: Tab. 301, figures 1–5, sub *Euxolus deflexus*), Carretero (1990: 560, figure 10).

Phenology:—Flowering from July to September.

Habitat:—Roadsides, flowerbeds, foot of walls, uncultivated land.

Elevation:—0–1000 m a.s.l.

FIGURE 6. *Amaranthus deflexus*: **A)** individual, **B)** synflorescence (Lazio, Rome province, Rome city, walkway), **C)** detail of flowers (Friuli-Venezia Giulia region, Trieste province, Trieste city, walkway). [photos by D. Iamonico (**A−B**), and F. Rossi (**C**)].

Chromosome number:—2n = 32, 34 (Carretero 1984 from Spain, Queirós 1989 from Portugal, Dobea & Hahn 1987 from Norway).

Alien status:—Neophyte species native to South America, it can be considered invasive in Italy. Nevertheless, no evident impacts were observed, excepting for some cases (uncultivated lands, and flowerbeds) in which *A. deflexus* forms mono- or paucispecific communities, decreasing the floristic richness of these habitats which constitute one of the greater floristic pool in the urban ecosystems.

Occurrence in Italy:—All Italian regions: invasive in PIE, LOM, TOS (Iamonico & Ferretti 2011), MAR, UMB, LAZ, ABR, MOL, CAM, BAS, CAL, and SAR; naturalized in VDA, TAA, VEN (see also Masin & Scortegagna 2012), FVG, LIG, EMR, PUG, and SIC.

Specimina Visa Selecta:—ITALY. **Abruzzo**: Pescara, Alanno, October 1955, *Anzalone s.n.* (RO!); vie litoranee Roseto degli Abruzzi alla spiaggia, 4 October 1956, *Zodda s.n.* (RO!); margine delle vie urbane, Teramo nell'abitato, 17 October 1956, *Zodda s.n.* (CAT!); Roseto degli Abruzzi, alla spiaggia, vie litoranee, 4 October 1956, *Zodda s.n.* (RO!); Roseto degli Abruzzi, lungo la spiaggia, 17 July 1965, *Zodda 5728* (APP!); Colle Santa Reparata, stazione di juniperus macrocarpa, tra Casoli e Roccascalegna, 17 Septemebr 1995, *Conti 40366* (APP!); L'Aquila, margine di strada, 750 m a.s.l., 29 August 2007, *Bartolucci 26950* (APP!); Collarmele, SS5, all'inizio del paese provenendo da Sulmona, margini stradali, 30 August 2008, *Iamonico s.n.* (HFLA!); Sulmona, piazza Garibaldi, margini stradali, 30 August 2008, *Iamonico s.n.* (HFLA!); L'Aquila, bordi di vie, 30 August 2008, *Iamonico s.n.* (HFLA!); L'Aquila, bordo mura di cinta (lato 99 cannelle), 30 August 2008, *Iamonico s.n.* (HFLA!); Anversa degli Abruzzi, verso l'orto botanico, 25 September 2009, *Conti 41140* (APP!). **Basilicata**: Potenza, Montereale ad vias, 820 m a.s.l., 11 September 1930, *Gavioli s.n.* (RO!); Maratea, bordi di vie, 12 August 2009, *Iamonico s.n.* (HFLA!). **Calabria**: Crotone, nella parte esterna del cimitero lato a monte, 2 June 1969, *Catanzaro s.n.* (RO!); ai piedi del Monte Miriste, 16 September 1979, *Toscano 2639* (CLU!); prov. Reggio di Calabria, Bagnara, 60 m a.s.l., 4 June 1997, *Spampinato 20382* (CLU!). **Campania**: Portici, October 1846, *sine coll. 90902* (PAL!); Napoli, 17 September 1877, *Pasquale s.n.* (RO!); Salerno, Madonna degli Angeli, 20 September 2004, *Del Guacchio & Petolicchio s.n.* (*Herb. Del Guacchio*!); Marina di Camerota, Porto, scalinata verso la fine del porto (dir. Lentiscelle), 15 August 2009, *Iamonico s.n.* (HFLA!); Avellino, Monteverde, presso la stazione, 18 Spetemebr 2010, *Del Guacchio s.n.* (*Herb. Del Guacchio*!). **Emilia-Romagna**: lungo le vie ne cantoni di Modena, 27 February 1878, *sine coll. s.n.* (RO!); lungo le strade a Faenza, June 1878, *Caldesi 90889* (PAL!); in Bologna vicino all'Orto Botanico, June 1882, *Pizzini s.n.* (RO!). **Lazio**: Ponza, 15 May 1900, *Béguinot s.n.* (RO!); Zannone, 27 September 1901, *Béguinot s.n.* (RO!); Zannone, May 1950, *Anzalone s.n.* (RO!); Viterbo, via S. Maria dei Gradi, 65, August 1957, *Bazzichelli s.n.* (RO!); Tor Vaianica, litorale tra T.V. e Tor S. Lorenzo, October 1957, *Anzalone s.n.* (RO!); Gaeta, serapo, ruderali presso la spiaggia, 20 July 1960, *Anzalone s.n.* (RO!); Castelli Romani, 3 October 1964, *Anzalone s.n.* (RO!); Isola di Ponza (Arcip. Ponziano), presso l'abitato e zona Monte Guardia, 29 September 1967, *Anzalone s.n.* (RO!); Isola di Ventotene, 2−5 May 1968, *Anzalone s.n.* (RO!); Isola di Zannone, 29 May 1968, *Anzalone s.n.* (RO!); Roma, Valle Giulia, 31 August 1970, *Anzalone s.n.* (RO!); Roma, Villa Ada, November 1972, *Anzalone s.n.* (RO!); Isola di Ventotene, 24 September 1976, *Anzalone s.n.* (RO!); Roma, presso P.te Risorgimento, riva sin. nelle scalette, September 1976, *Anzalone s.n.* (RO!); Tenuta di Castelporziano (Roma), i Pantani, July 1986, *Anzalone s.n.* (RO!); Roma, Roma, P.te Flaminio, September 2002, *Anzalone s.n.* (RO!); Roma, Parco degli Acquedotti, incolti, 10 July 2007, *Iamonico s.n.* (HFLA!); Gaeta, Contrada Canali, bordi di vie, September 2007, *Iamonico s.n.* (HFLA!); Lago di Nemi, (sponda SE), incolti, 19 Septemebr 2007, *Iamonico s.n.* (HFLA!); Minturno, stazione, September 2007, *Iamonico s.n.* (HFLA!); Valmontone, bordi di vie presso staz. ferroviaria, 15 October 2008, *Iamonico s.n.* (HFLA!). **Lombardia**: Garlasco (Pavia), strade, 20 August 1889, *Canneva s.n.* (RO!); Milano, lungo la via Imbonati, 28 August 1970, *Catanzaro s.n.* (RO!); lungo le sponde del lago, vicino la funicolare per Brunnate, Como, 29 August 1970, *Catanzaro s.n.* (RO!); Mantova, Suzzara, strada Donella, terra da riporto, 30 June 2002, *Truzzi 280* (*Herb. Truzzi*!). **Liguria**: Sestri di Ponente, nell'alveo del torrente che scende dal Gazzo, 1841, *Rovellini s.n.* (RO!); Portofino, 7 September 1892, *Grampini s.n.* (RO!); Albissola mare (Savona) negli asfalti antistante la piazza del capolinea dell'autobus, 26 October 1969, *Catanzaro s.n.* (RO!); lungo i binari della stazione ferroviaria di Genova Brignole, 6 August 1970, *Catanzaro s.n.* (RO!); Torre del mare (Savona), lungo il litorale, 7 August 1970, *Catanzaro s.n.* (RO!); Albenga, lungo le sponde del fiume, Genta nel tratto che dal centro urbano porta alla foce, 18 August 1970, *Catanzaro s.n.* (RO!); lungo i binari della stazione ferroviaria di Savona, 12 August 1970, *Catanzaro s.n.* (RO!). **Marche**: dintorni di Senigallia tra Senigallia e Ponte Cesano, luoghi maceriosi ed erbosi incolti, suolo prevalentemente argilloso, 7 Septemebr 1964, *Brilli-*

Cattarini 2587 (PESA!); Senigallia, in arenosis maritimis, August 1877, *coll. illeg. s.n.* (FI!); dintorni di Porto Potenza Picena nel litorale in destra della foce del torr. Asola, ruderati e luoghi erbosi incolti, suolo prevalentemente calcareo, humus nullo, 12 October 1990, *Brilli-Cattarini et Gubellini s.n.* (PESA!); San Benedetto del Tronto, Sentina, 0−10 m a.s.l., 8 June 2009, *Conti 41890* (APP!). **Piemonte**: Vercelli, *sine die*, *Cesati 90904* (PAL!); Turin, *s.d.*, *Pedicino s.n.* (RO!); Mergozzo, Piazza C. Cavour, riva lastricata, 16 Septemebr 2002, *Antonietti s.n.* (*Herb. Antonietti*!); Verbania, terreno sabbioso, 195 m a.s.l., 22 October 2003, *Antonietti s.n.* (*Herb. Antonietti*!); Vogogna, a monte di Cantone, golena sin. Del Toce, terreno sabb., 13 October 2004, *Antonietti s.n.* (*Herb. Antonietti*!); Cannero, mulatt., sedime/bordo a monte, 240 m a.s.l., 19 May 2011, *Antonietti* (*Herb. Antonietti*!); Domodossola, fessura casa/asfalto, 20 June 2001, *Antonietti s.n.* (*Herb. Antonietti*!); Belgirate, ghiaietto, 201 m a.s.l., 28 September 2012, *Antonietti* (*Herb. Antonietti*!). **Puglia**: in cultis prope Gallipoli, June 1883, *Groves s.n.* (FI!); Maglie, muro a secco, 30 July 1991, *Nucita s.n.* (LEC!); Lecce, Via Gallipoli, aiuola, 8 October 1990, *Nifosi s.n.* (LEC!); Lecce, Via Adria, marciapiede, 24 Septemebr 1995, *Mele & Annese s.n.* (LEC!); Lecce, Piazza Italia, aiuola, 5 October 1995, *Mele & Annese s.n.* (LEC!); Lecce, P.ta S. Chiara, aiuola, 21 May 1997, *Mele & Annese s.n.* (LEC!); Santuario dell'Incoronata (Foggia), 2 August 2007, *Galesi 000171* (CAT!); Bari, via Ulpiani (all'ingreso dell'Hotel Campus), bordo strada, 1 July 2008, *Iamonico s.n.* (HFLA!); Bari, corso Cavour, giaridni pubblici, 1 July 2008, *Iamonico s.n.* (HFLA!); Isole Tremiti, San Domino, monastero abbandonato sopra il paese, bordi di vie, 17 August 2012, *Iamonico s.n.* (HFLA!); Alberobello, zona monumentale dei trulli, marciapiede, 21 August 2013, *Iamonico s.n.* (HFLA!). **Sardegna**: Santa Teresa di Gallura, par Tempio, 12 August 1881, *Reverchon 90890* (PAL!); ad vias prope Cagliari, July, *Müller s.n.* (RO!); Berchidda, Rio S'isteramadu, 200−220 m, 3 Septemebr 2005, *Calvia s.n.* (*Herb. Calvia*!); Berchidda, Tempio Pausania, Passo Limbara, incolti aridi, cigli stradali, 650−700 m, 31 August 2006, *Calvia s.n.* (*Herb. Calvia*!); Olbia-Tempio, Calangianus, Badu Mela, incolti, strade, massicciate ferroviarie, 450−500 m, 3 September 2011, *Calvia s.n.* (*Herb. Calvia*!). **Sicilia**: Catania, November 1869, *sine coll s.n.* (RO!); Paternò, 15 September 1875, *Berénger s.n.* (PERU!); Pantelleria, sulla montagna grande con *Chenopodium ambrosioides*, August 1959, *Catanzaro s.n.* (RO!); Catania, September 1869, *sine coll. s.n.* (RO!); lungo i binari della stazione ferroviaria di Mazara del Vallo (Trapani), 9 September 1969, *Catanzaro s.n.* (RO!); lungo i binari della stazione ferroviaria di Alcamo (Trapani), 16 Novembere 1969, *Catanzaro s.n.* (RO!); Lipari, *s.d.*, *sine coll. 59040* (PAL!). **Toscana**: Firenze, 1830, *sine coll. s.n.* (FI!); margini delle strade di Pisa, September 1847, *sine coll. 90909* (PAL!); A Corvaia, presso Seravezza, 13 June 1890, *Cicioni s.n.* (PERU!); Insula Pianosa, Lavanderia vecchia, 15 May 1901, *Sommier s.n.* (RO!); Rignano sull'Arno, macerie, 27 September 1932, *Montelucci s.n.* (RO!); Montevarchi, binari morti alla stazione FS, 11 October 1962, *Montelucci s.n.* (RO!); Siena, San Miniato, via G. di Vittorio, 12 Septemebr 2008, *Iamonico s.n.* (HFLA!); Firenze, via Novelli, marciapiede, 1 August 2009, *Iamonico s.n.* (HFLA!); Fiesole, via Adriano Mari, bordo strada, 3 August 2009, *Iamonico s.n.* (HFLA!); Firenze, via Caroli, marciapiedi, 16 June 2010, *Iamonico s.n.* (HFLA!). **Trentino-Alto Adige**: Bolzano, Gries, an der Fagenstraβe Höhe Postant, Straβenrand, Hecke, 7 October 2004, *Wilhalm s.n.* (BOZ!). **Umbria**: Trasimeno all'Is. Maggiore, 25 July 1886, *Cicioni s.n.* (PERU!); Monte Mache? Presso Perugia, 20 August 1887, *Tarpani 3611* (CAT!); Civitella d'Arna (Perugia), 28 July 1890, *Cicioni s.n.* (PERU!); Lago Trasimeno, Monte del Lago, centro storico, 80 m a.s.l., 6 September 2011, *Till 111019* (WU!). **Valle d'Aosta**: S. Martino d' Aosta, salita per la valle del Lys, 27 July 1877, *Carestia s.n.* (TO!); Tra Pont St. Martin e Lillianes, 28 July 1905, *Vaccari s.n.* (FI!); Aosta, campi, 600 m a.s.l., August 1931, *Zodda s.n.* (CAT!); Pont-Saint-Martin, sul ponte romano alla base dei muretti, 365 m a.s.l., 15 September 1993, *Bovio s.n.* (AO!); Aosta, a nord della ferrovia (via Carrel, angolo via Garibaldi), 575 m a.s.l., 29 November 2004, *Bovio s.n.* (*Herb. Bovio*!); Verrès, a Torille al margine del piazzale del ristorante, 29 September 2008, *Bovio et Trompetto s.n.* (FI!). **Veneto**: Grezzana, Valle Pantena, ad muros, February 1887, *Goiran s.n.* (RO!); Verona, in vias urbis, October 1888*, Goiran 90913* (RO!); Belluno, incolto calpestato, 8 August 1985, *Argenti 9839/3* (*Herb. Argenti*!); Cavarzano, ruderale, 29 August 2009, *Argenti 9839/1* (*Herb. Argenti*!).

5. *Amaranthus albus* L., Syst. Nat., ed. 10. 2: 1268. 1759 (Fig. 7).

Type (lectotype designated by Raus 1997: 143):—NORTH AMERICA. *Habitat (in Philadelphiae maritimis), Herb. Linn. No. 1117.1* (LINN!).

Description:—Herbs 1–85(–120) dm tall, monoecious, annual (therophyte), rarely biennial. Stems usually erect, ± glabrous (sometimes sparsely pubescent in the inflorescence region), white to white-greenish, much branched.

Leaves green (usually pale green), ovate, elliptic to spathulate (3.5–6.0 × 1.5–3.0 cm in the main axis, greater than the leaves on the branches), often with undulate margins (sometimes with a white marginal vein), apex obtuse and mucronate, base cuneate, glabrous (rarely pubescent on the veins), petioled (petiole 1.6–3.0 cm long). Synflorescences arranged in axillary glomerules, light green. Floral bracts greenish, ovate-lanceolate [(2.0–)3.0–4.0(–6.0) × 0.3−0.6 mm], 2(−2.5) times longer than the perianth, awned, margin entire, glabrous. Staminate flowers with 3 tepals, lanceolate; stamens 3. Pistillate flowers with 3 tepals, linear to lanceolate [0.9–1.1 × 0.3–0.4(−0.5) mm], with acute apex; stigmas 3. Fruit brownish-black, ellipsoidal [(1.2–)1.4–1.8 × 1.0–1.2(–1.4) mm], as long as or slightly longer than the perianth, rugose when dry, dehiscent. Seed lenticular [(0.8–)0.9–1.1(–1.3) mm in diameter], black to brownish-black.

Iconography:—Arrigoni & Viegi (2011: 16, Tav. 3), Costea & Tardif (2003c: 1046, Fig. 5.E).

Phenology:—Flowering from June to September.

Habitat:—Uncultivated and cultivated lands, roadsides, railways, backfills.

Elevation:—0–850 m a.s.l.

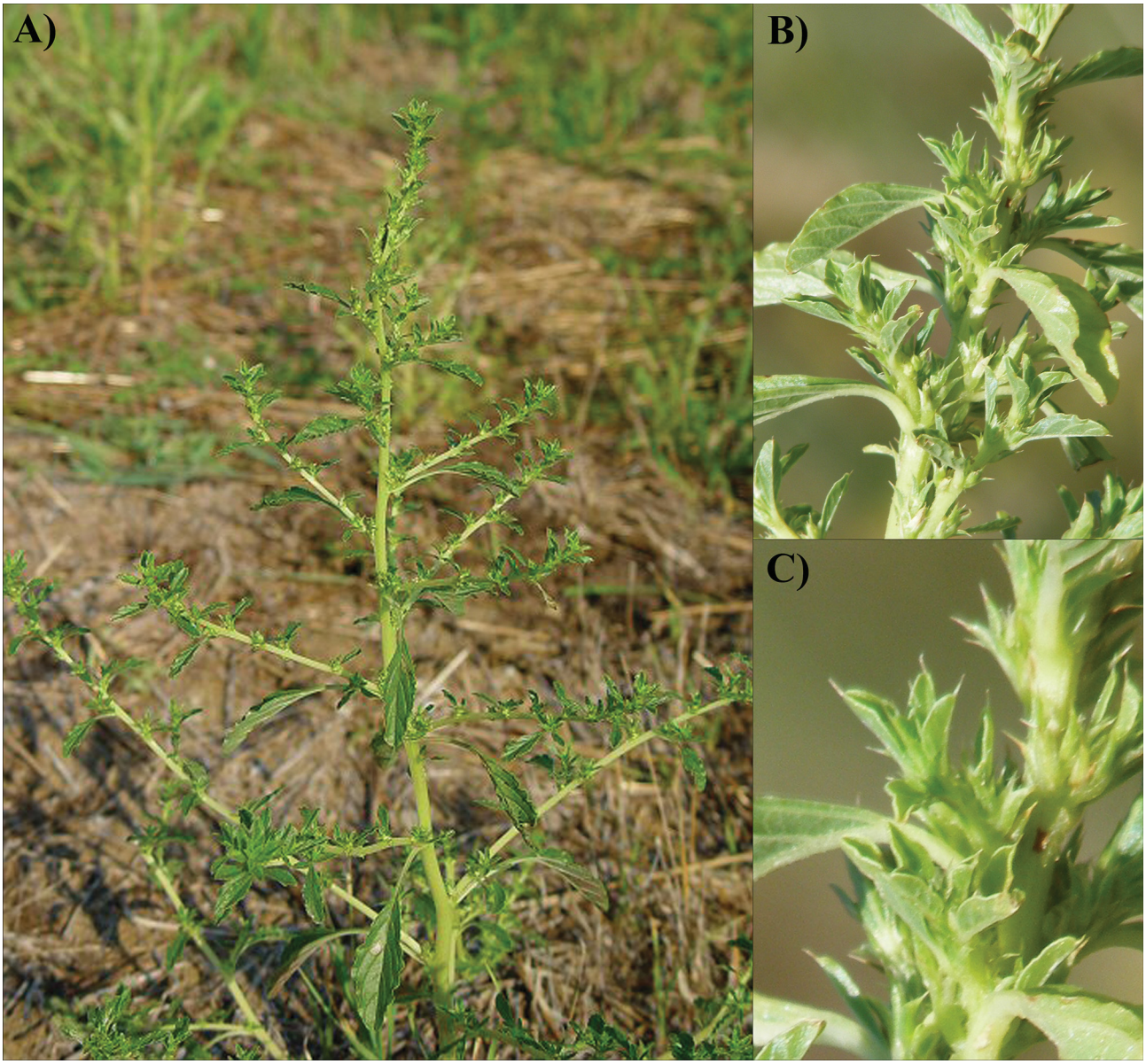

FIGURE 7. *Amaranthus albus* (Umbria, Terni province, Terni city, uncultivated land): **A)** individual, **B)** synflorescence, **C)** detail of flowers (photos by D. Iamonico).

Chromosome number:—2n = 32, 34 (Heiser & Whitaker 1948, Sharma & Banik 1965, Hindáková & Schwarzova 1978, 1987 from Slovakia, Madhusoodanan & Pal 1981, Madhusoodanan & Nazeer 1983, Mulligan

1984, Dmitrieva 1986 from Belarus, Queirós 1989 from Portugal, Song *et. al.* 2002, Sheidai & Mohammadzdeh 2008).

Alien status:—Neophyte species native to North America, it can be considered invasive in Italy. Nevertheless, no evident impacts were observed, excepting for some cases (cultivated fields), in which *A. albus* forms large populations that could cause a decrease of crop efficiency (economical impact).

Occurrence in Italy:—All Italian regions: invasive in LOM, LAZ, BAS, CAL and SAR; casual alien in VDA (Iamonico & Bovio 2013), and LIG; naturalized in the other regions [Masin & Scortegagna (2012) reported *A. albus* as casual for central and southern VEN].

Taxonomic annotations:—Pulvinate forms (20–40 cm in diameter) with reduced leaves (5–10 mm long) can be observed along roadsides (f. *viarum* Priszter). Some herbaria sheets bearing pulvinate plants were ofted misidentified as *A. crispus* (Lesp. & Thév.) A.Braun ex J.M.Coult. & S.Watson, probably by the undulate leaves (see the diagnostic key and the description of *A. crispus* for the differences). Costea & Tardif (2003c) reported "...The pattern of branching and size of the plants and leaves are influenced by the availability of light, water and nutrients. Mechanical factors such as clipping or trampling trigger development of secondary branches. Such ecophenes do not deserve taxonomic status...". However, both erect and pulvinate forms were observed in the same site (so at the same ecological conditions). Further studies (cultivation tests, molecular analyses) need to verify the identity of these forms.

Specimina Visa Selecta:—ITALY. **Abruzzo**: fiume Pescara (Castel. Aldr.), 3 September 1909, *Rossetti s.n.* (RO!); Pescara, 4 October 1955, *Anzalone s.n.* (RO!); Sulmona, staz FF.SS., uscendo dal Parco Nazionale d'Abruzzo, 16 August 1956, *Anzalone s.n.* (RO!); S. Silvestro (Ofena), 354 m a.s.l., 15 October 2006, *Conti 34452* (APP!); Collarmele, SS5 all'inizio del paese provenendo da Sulmona, margini stradali, 30 August 2007, *Iamonico s.n.* (HFLA!); Collarmele, SS5, passaggio a livello, 30 August 2007, *Iamonico s.n.* (HFLA!); Torino di Sangro, lecceta, 15 September 2009, *Conti & Manzi 46247* (APP!); Torino di Sangro, margine superiore della lecceta, 31 September 2009, *Conti & Manzi 40948* (APP!). **Calabria**: Crotone (Capo Colonna). Litorale, 21 September 1968, *Catanzaro s.n.* (RO!); Mordello (Spezzano Albanese, Prov. Cosenza), 40 m a.s.l., 6 December 2006, *Bernardo 21522* (CLU!); Cosenza, foce Fiume di Mare, Fiumefreddo Bruzio Marina, 5 m a.s.l., September 1998, *coll. illeg. 2821* (CLU!). **Campania**: Avellino, Monnteverde, autostrata per il fiume Ofanto, 10 Setember 2010, *Del Guacchio s.n.* (*Herb. Del Guacchio*!). **Emilia-Romagna**: nei coltivati a Casalecchio, presso Bologna, August 1883, *Pizzini s.n.* (RO!); in ruderatis Parmae, *s.d.*, *Passerini 90864* (PAL!); provincia di Modena, Casinalbo, suolo alluvionale, 80 m a.s.l., August 1927, *Adr. Fiori 9623* (BI!); Prov. Di Modena, Casinalbo lungo la via Giardini, 31 August 1942, *Adr. Fiori 9614* (BI!); stazione di Ferrara, fessure di lastricato, 6 m a.s.l., *coll. illeg. 2779* (FER!); Poggio Renatico (Ferrara), stazione ferroviaria, fessure di marciapiedi, 10 October 2009, *coll. illeg. s.n.* (FER!). **Friuli-Venezia Giulia**: Opicina (Trieste), lungo la strada, 3 October 1948, *Sallis s.n.* (RO!). **Lazio**: Ponza, 28 May 1901, *Béguinot s.n.* (RO!); Roma, via di Decima (presso osteria Malpasso), July 1954, *Anzalone s.n.* (RO!); Ostia, Castelfusano, lungo la via litoranea poco prima dello sbocco dal Viale Crist. Colombo, 7 January 1956, *Anzalone s.n.* (RO!); Rive del lago di Bolsena (verso Capo di Monte), 31 August 1958, *Bazzichelli s.n.* (RO!); Roma, presso Ponte Milvio (riva sin.), September 1977, *Anzalone s.n.* (RO!); Tenuta di Castelporziano (Roma), September 1988, *Anzalone s.n.* (RO!); Roma, Riserva Naturale Lurentino-Acqua Acetosa, macerie, 12 August 2006, *Iamonico s.n.* (HFLA!); FS cancelliera, 6 Septemebr 2008, *Iamonico s.n.* (HFLA!); Colleferro, FS, binari in uso, 15 October 2008, *Iamonico s.n.* (HFLA!); Valmontone, lungo i binari, 15 October 2008, *Iamonico s.n.* (HFLA!); Ostia, Infernetto, bordo via principale, 9 August 2009, *Iamonico s.n.* (HFLA!). **Lombardia**: Como, giardini pubblici, prati, 1 October 1938, *Ceroni s.n.* (PAV!); Como, via dei Mulini, macerie, September 1944, *Ceroni s.n.* (PAV!); piazzale antistante la stazione centrale Milano, 28 August 1970, *Catanzaro s.n.* (RO!); Monza e Brianza, Lambiate, staz. FS, marciapiedi, massicciate, 20 September 1995, *Giordana s.n.* (*Herb. Giordana*!). **Liguria**: lungo i binari della stazione ferroviaria di Genova, 11 August 1970, *Catanzaro s.n.* (RO!); lungo i binari della stazione ferroviaria di Savona, 12 August 1970, *Catanzaro s.n.* (RO!); lungo i binari della stazione ferroviaria di Albenga, 18 August 1970, *Catanzaro s.n.* (RO!); Sarzana, *s.d.*, *Bertoloni 90867* (PAL!). **Marche**: Pesaro, presso la spiaggia al margine orientale della città, luoghi maceriosi, suolo prevalentemente sabbioso, 21 October 1964, *Brilli-Cattarini 2531* (PESA!); Ancona, nella stazione ferroviaria, ambienti ruderali, suolo prevalentemente calcareo, humus nullo, 14 October 1973, *Brilli-Cattarini 2534* (PESA!); dintorni di Morrovalle sulla sponda sinistra del Chienti presso il Ponte di Trodica, ruderatis, uolo prevalentemente calcareo, humus subnullo, 22 September 1980, *Brilli-Cattarini et Gubellini 2527* (PESA!); dintorni di Ancarano sull'alveo del Tronto tra il Ponte di Ancarano e il Ponte di Pagliare,

depositi alluvionali ghiaiosi, suolo prevalentemente ar calcareo, humus nullo, 19 September 1985, *Brilli-Cattarini et Gubellini 2526* (PESA!). **Piemonte**: Torino, fra le macerie degli antichi spalti, August 1857, *Cesati 90858* (PAL!); Torino, nuova Piazza d'Armmi, Septembre 1884, *Canneva s.n.* (RO!); città di Torino, 6 August 1889, *Cesati s.n.* (RO!); Domodossola, staz. FS binario 1 (ra binario e marciapiede), terreno ciottoloso, 270 m a.s.l., 23 August 2006, *Antonietti s.n.* (*Herb. Antonietti*!). **Puglia**: Lecce, Corte S. Cataldo, strada, 36 June 1996, *Mele & Annese s.n.* (LEC!); Lecce, Piazza Italia, aiuola, 16 July 1996, *Mele & Annese s.n.* (LEC!); Lecce, S. Cataldo, incolto, 16 January 1997, *Luciano s.n.* (LEC!); Via Gallipoli (Lecce), aiuola ombrosa, 10 June 1998, *sine coll. s.n.* (LEC!); Canale dell'Arno (Galatina), sponda, 11 January 2000, *Beccarisi s.n.* (LEC!); Bari, viale Papa Pio XII, bordi di vie, 1 July 2088, *Iamonico s.n.* (HFLA!). **Sardegna**: presso Iglesias, 1871, *sine coll. 90862* (PAL!); Musei, September 1872, *Reina 90874* (PAL!); Oschiri, ponte Diana, prati aridi, incolti, cigli stradali, 164−180 m, 22 August 2006, *Calvia s.n.* (*Herb. Calvia*!); Berchidda, Badu 's Chegia, 250−300 m, 25 September 2008, *Calvia s.n.* (*Herb. Calvia*!); Berchidda, Tempio Pausania, zona industriale, 450−500 m, 15 August 2010, *Calvia s.n.* (*Herb. Calvia*!). **Sicilia**: In ruderatis—Bagheria, September, *Todaro s.n.* (RO!); Etna, Bosco Milo, volcanic soil, 700−800 m a.s.l., 11 June 1990, *Raimondo et al. 68248* (PAL!); Incolti fra Diga Delia e Mazara (Trapani), 25 July 2006, *Scuderi 020141* (CAT!); Bagheria, *s.d.*, *sine coll. 59003* (PAL!). **Toscana**: Viareggio, in arenosis maritimis, July 1850, *Calandrini s.n.* (RO!); Livorno, luoghi abbandonati fuori le mura, October 1874, *Cesati s.n.* (RO!); Bagni di Casciano, ruderi e luoghi incolti, 15 August 1876*, Cicioni s.n.* (PERU!); al Forte dei Marmi (vicinato), campi, August−Septemebr 1886, *Santarelli 9622* (BI!); Pisa P. alle Piagge, August 1888, *Santarelli 9621* (BI!); Porpe Pisas (Selva pisana), in arenosis incultis, 30 September 1896, *Sommier s.n.* (RO!); Arcela nei luoghi coltivati (Massa C.), July 1902, *Santarelli 9618* (BI!); Rignano, greto dell'Arno, al Mulino, 28 Septemebr 1931, *Montelucci s.n.* (RO!); a Viareggio, July 1950, *sine coll. s.n.* (RO!); Bosco Fiesole, pineta, 18 August 1964, *Stampi s.n.* (FI!); Pisa, Bagni di Casciano, ruderi e incolti, 15 August 1976, *Berénger s.n.* (PERU!); between Montepulciano and Monte Follonico, after Foso dei Grilloni between Colombelline and Podere Lupain, 340 m a.s.l., 15 September 2011, *Till 111067* (WU!). **Umbria**: Trasimeno presso Montalera, 22 July 1886, *Cicioni s.n.* (PERU!); Perugia (Prugneto), October 1886, *Cicioni s.n.* (PERU!); presso Montemignone al Niccone (Umbertide), 26 September 1887, *Cicioni s.n.* (PERU!). **Valle d'Aosta**: Chambave, Stazione, incolto presso i binari abbandonati, 469 m a.s.l., 12 Septemeber 2006, *Bovio, Gerard. et Poggios.n.* (AO!); Aymavilles, località Les Crêtes, vigne, 705 m a.s.l., 28 July 2007, *Bovio et Poggio s.n.* (AO!). **Veneto**: lungo il nuovo argine del fiume Brenta a Cà Pasqua presso Chioggia, in prov. di Venezia, October 1868, *Mazzanti s.n.* (RO!); lungo il nuovo argine del fiume Brenta a Ca Pasqua presso Chioggia, October 1888, *Mazzanti s.n.* (RO!); Belluno, Feltre, Stazione FF.SS., 23 April 1900, *Ugolini 9937/3* (PAD!); Loc. Venetia - Prov. Di Venezia, in arenosis hortorium prope Cavanella d'Adige, non longe a mari, October 1913, *sine coll. s.n.* (RO!); *ibidem, Béguinot 766* (CAT!); *ibidem* (BI!); Belluno, Calalzo di Cadore, binari della staz. FF.SS., 18 August 1921, *Ugolini 9540/3* (PAD!); prope Verona in aggere obliquo alla Madonna di Campagna, September 1883, *Goiran 90863* (PAL!).

6. *Amaranthus viridis* L., Sp. Pl., ed. 2. 2: 1405. 1763 (Fig. 8).

Type (lectotype designated by Fawcett & Rendle 1914: 131):—UNKNOWN ORIGIN. *Habitat in Europa, Brasilia, Herb. Linn. No. 1117.15* (LINN!).

Description:—Herbs 1–7(–8) dm tall, monoecious, annual (therophyte). Stems erect, glabrous, green to brownish, branched. Leaves black-green, ovate, rhomboidal [(2.0–)3.0–8.0(–10.0) × (1.5–)2.0–6.0(–7.0) cm], with entire margins (rarely undulate), apex obtuse or rounded (rarely slightly emarginate) and sometimens mucronate, base usually cuneate, usually glabrous, petioled [petiole (2.0–)3.0–6.0(–11.0) cm long]. Synflorescences terminal, spike- or panicle-like (sometimes axillary glomerules also occur), the main florescence up to 20 cm long, green to brown, often thin (5−7 mm in diameter). Floral bracts yellowish or greenish, ovate to lanceolate [0.5–1.0 × 0.4−0.7 mm], shorter (up to ⅓) than the perianth, acuminate, margin entire, glabrous. Staminate flowers with 3 tepals, ovate; stamens 3. Pistillate flowers with 3 tepals, ovate-lanceolate or obovate-spathulate (1.2−1.5 × 0.3–0.6 mm), with rounded apex (sometimes acute), mucronate or not; stigmas (2−)3. Fruit brownish, subglobose [(1.2–)1.4–1.7(–1.9) × 1.4–1.6(–1.8) mm] as long as or slighly longer (up to ¼) than the perianth, clearly rugose, indehiscent. Seed lenticular (0.8–1.2 mm in diameter), black or brownish-black.

Iconography:—Carretero (1990: 560, figure 12), Bojian *et al.* [2003: 420, figure 339(5–8)].

FIGURE 8. *Amaranthus viridis*: **A)** individual, **B)** synflorescence, **C)** detail of flowers (Lazio, Rome province, Rome city, walkway) (photos by D. Iamonico).

Phenology:—Flowering from July to September.

Habitat:—Flowerbeds, roadsides, railways, uncultivated lands.

Elevation:—0–300 m a.s.l.

Chromosome number:—2n = 34 (Sharma 1970, Baquar & Olusi 1988, Madhusoodanan & Nazeer 1983, Ugborogho & Oyelana 1992, Song & al. 2002, Sheidai & Mohammadzdeh 2008).

Alien status:—Neophyte species probably native to South America, it can be considered invasive in Italy. Nevertheless, no evident impacts were observed [potential ecological impacts (decreasing of the floristic richness) into uncultivated lands, and flowerbeds of the urban ecosystems].

Taxonomic annotations:—The name *Amaranthus gracilis* Desf. was cited by several Italian authors, either as a separate species [e.g., Cacciato (1966), Zangheri (1976) reported "*A. gracilis* Desf. è ± simile ad *A. defléxus*, però ha fr. ± sferici di 1–1,5 mm Ø, rugolosi, assai più corti dei tepali" ("*A. gracilis* Desf. is ± similar to *A. deflexus*, but it has spherical fruits 1–1.5 mm in diameter, rugose, much shorter than the tepals")] or as a synonym of *A. viridis* (e.g., Pignatti 1982, Anzalone *et al.* 2010). *Amaranthus gracilis* was first published by Desfontaines (1804) as a replaced synonym for *Chenopodium caudatum* Jacq. [blocked under *Amaranthus* by *A. caudatus* L.]. Later, Poiret (1810) provided a description citing again *C. caudatum* as a synonym and stating that "Cette plante offre dans les fleurs tous les caractères des amaranthes, & ne pouvoit rester parmi les chenopodium" ("This plant shows all flowers with the characters of *Amaranthus*, and it cannot belong to *Chenopodium*"). Jacquin (1789, April) published the name *Chenopodium caudatum* providing a detailed description, although no data about the flower characters were given. Some months earlier, Jacquin (1788, February−March) published a good iconography of his *C. caudatus* showing both a complete plant and a magnification of one flower. According to the art. 9.3a of the ICN (McNeill *et al.* 2012) this image can be considered as the holotype of the name *Chenpodium caudatum* (W. Greuter pers. comm.). The flower occurring in the Jacquin's illustration has the following characteristics: it is bisexual, with 5 tepals, 5 stamens and one pistil with bifid stigma. Since the genus *Amaranthus* has only unisexual flowers, Jacquin's plant cannot belong to *Amaranthus* and Desfontaines' choice is not correct [moreover *A. viridis* has always 3 tepals and 3 stamens (in male flowers)]. Furthermore, on the basis of the position of the stamens showed in the image (alternate to the perianth segments), the Jacquin's plant cannot be also ascribed to any member of Chenopodiaceae (A. Sukhorukov pers. comm.). An ongoing nomenclatural study on the name *Ch. caudatum* has the aim to clarify the situation (D. Iamonico and collaborators, in preparation). However, concerning Italy, *A. gracilis* appears to be misapplied for *A. viridis*.

Occurrence in Italy:—Invasive in LAZ, CAM (Stinca & al. 2013), CAL, and SAR; naturalized in VEN (see also Masin & Scortegagna 2012), LOM, PUG, SIC; casual alien in FVG, LIG, TOS, and UMB (Iamonico 2012d); formerly recorded in EMR. Recently excluded from PIE (Iamonico 2010d).

Specimina Visa Selecta:—ITALY. **Calabria**: Tropea, bordi di vie, 29 September 2007, *Iamonico s.n.* (HFLA!). **Campania**: Napoli, Portici, Parco Gussone, 8 September 2002, *Del Guacchio & Gargiulo s.n.* (*Herb. Del Guacchio*!). **Lazio**: Gaeta, Contrada Canali, bordi di vie, September 2007, *Iamonico s.n.* (HFLA!); Gaeta, lungomare Serapo, spiagge, September 2007, *Iamonico s.n.* (HFLA!); Ciampino, via Bleriot, bordo strada, September 2007, *Iamonico s.n.* (HFLA!); Roma, Caffarella, bordi di vie, 3 October 2007, *Iamonico s.n.* (HFLA!); Roma, via Roccagorga, 7 july 2007, *Iamonico s.n.* (HFLA!); Roma, viale di Villa Pamphili, bordo via, 4 June 2008, *Iamonico s.n.* (HFLA!); Roma, via Appia Pignatelli, 10 June 2008, *Iamonico s.n.* (HFLA!); Ostia, via del Canale della Lingua (all'altezza di viale di Castel Porziano), sponda destra fosso, 20 December 2009, *Iamonico s.n.* (HFLA!). **Liguria**: argine sinistro del Polcevera (Genova) a monte del Ponte Rivarolo-Borzoli, 23 October 1905, *sine coll s.n.* (RO!); lungo i binari della stazione ferroviaria di Genova principe, 11 August 1970, *Catanzaro s.n.* (RO!); lungo i binari dello scalo merci della stazione ferroviaria di Savona, 18 August 1970, *Catanzaro s.n.* (RO!); lungo la strada per Sassello in Vicinanza del cimitero Albissola Cojo, 20 August 1970, *Catanzaro s.n.* (RO!). **Puglia**: Lecce, piazza Italia, aiuola, 7 October 1996, *Mele & Annese s.n.* (LEC!); Lecce, Castello Carlo V, marciapiede, 26 June 1996, *Mele & Annese s.n.* (LEC!); Lecce, Via Taranto, bordo strada, 2 June 1998, *Mele s.n.* (LEC!); Lecce, 6 August 1998, *Luciano s.n.* (LEC!). **Sicilia**: lungo i binari della stazione ferroviaria di Termini Imerese (Palermo), 31 July 1930, *Catanzaro s.n.* (RO!); Messina, stazione ferroviaria muri...tra i binari, 18 July 1967, *Cacciato s.n.* (FI!); lungo i binari della stazione ferroviaria di Alcamo diramazione (Trapani), 16 January 1969, *Catanzaro s.n.* (RO!); Mazara del Vallo, lungo i binari della ferroviaria Trappeto, 18 September 1969, *Catanzaro s.n.* (RO!); Palermo, lungo i binari della ferroviaria Trappeto, 21 November 1969, *Catanzaro s.n.* (RO!); Messina, lungo i binari della ferrovia Furnari, 21 July 1970, *Catanzaro s.n.* (RO!); Diga Disueri (Gela), 9 December 2006, *Sciandrello 030521* (CAT!); centro abitato di Trecastagni, 21 June 2007, *Galesi 324069* (CAT!); in diversi luoghi della piana di Catania, *s.d.*, *sine coll. s.n.* (RO!). **Umbria**: Terni, via Gianbattista Vico, bordi di vie, 131 m s.l.m., 3 September 2011, *Iamonico s.n.* (HFLA!).

7. *Amaranthus tricolor* L., Sp. Pl. 2: 989. 1753 (Fig. 9).

Type (lectotype designated by Townsend 1974: 14):—ASIA. *Habitat in India, Herb. Linn. No. 1117.7* (LINN!).

= *Amaranthus melancholicus* L., Sp. Pl. 2: 989. 1753. ≡ *Amaranthus tricolor* var. *melancholicus* (L.) Lam. & Monnet, Encycl. [J. Lamarck & al.] 1: 115. 1783. Type (lectotype designated by Townsend 1994: 11):—ASIA. *Habitat in India, Herb. Linn., No. 1117.4* (LINN!).

= *Amaranthus tristis* L., Sp. Pl. 2: 989. 1753. ≡ *Amaranthus tricolor* var. *tristis* (L.) Thell. in Asch. & Graebn., Syn. Mitteleur. Fl. [Ascherson & Graebner] 5: 274. 1914. ≡ *Amaranthus tricolor* subsp. *tristis* (L.) Aellen in Hegi, Ill. Fl. Mitt.-Eur. 3(2): 495. 1959. Type (lectotype designated by Iamonico 2014a: 149):—ASIA. *Habitat in China, Herb. Linn., No. 1117.11* (LINN!).

= *Amaranthus mangostanus* L., Cent. Pl. I. 32. 1755. ≡ *Amaranthus tricolor* var. *mangostanus* (L.) Thell. in Asch. & Graebn. Syn. Mitteleur. Fl. [Ascherson & Graebner] 5: 274. 1914. ≡ *Amaranthus tricolor* subsp. *mangostanus* (L.) Aellen, in Hegi, Ill. Fl. Mitt.-Eur. 3(2): 495. 1959. Type (lectotype designated by Iamonico 2014a: 147):—ASIA. *Habitat in India, Herb. Linn., No. 1117.10* (LINN!).

= *Amaranthus polygamus* L., Cent. Pl. I. 32. 1755. ≡ *Amaranthus tricolor* subsp. *tristis* var. *polygamus* (L.) Aellen in Hegi, Ill. Fl. Mitt.-Eur. 3(2): 495. 1959. Type (lectotype designated by Iamonico 2014a: 148):—ASIA. *Habitat in India, Herb. Linn., No. 1117.9* (LINN!).

Description:—Herbs (5–)7–11(–15) dm tall, monoecious, annual (therophyte). Stems erect, ± glabrous, green or red, branched (rarely simple). Leaves green, red, red-purpureus or red-yellow mixed, ovate to lanceolate [(5.0–)7.0–15.0(–20.0) × (2.0–)5.0–10.0(–12.0)], with usually entire margins, apex obtuse to emarginate, often mucronate, base cuneate, glabrous, petioled (petiole 2–6 cm long). Synflorescences arranged in axillary glomerules or terminal, spike- or panicle-like, green to reddish. Floral bracts, usually greenwish, ovate-lanceolate [(2.0–)2.5–3.0(–3.5) × 0.8−1.8 mm] as long as the perianth, usually awned, margin entire, glabrous. Staminate flowers with 3 tepals, ovate to lanceolate, apex acute, awned; stamens 3. Pistillate flowers with 3 tepals, lanceolate-ovate (5.0–6.0 × 1.5–2.5 mm); stigmas 2−3. Fruit brown, subglobose to ellipsoidal (2.0–2.5 × 0.8–1.3 mm), shorter than the perianth, rugose, dehiscent. Seed lenticular (0.9–1.1 mm in diameter], black or brownish-black.

FIGURE 9. *Amaranthus tricolor*: exsiccatum from Rome city (Lazio) preserved at RO.

Iconography:—Aellen (1959: 471, figures 221–222, respectively sub *A. tricolor s.s.*, and *A. tricolor* subsp. *mangostanus*), Bojian *et al.* [2003: 420, figure 338(7−10)].

Phenology:—Flowering from July to September.

Habitat:—Human-made habitats near gardens.

Elevation:—0–300 m a.s.l.

Chromosome number:—2n = 34, 68, 85 (Madhusoodanan & Nazeer 1983, Madhusoodanan & Pal 1981, 1983, Paiva & Leitao 1989, Baquar & Olusi 1988, Song & al. 2002).

Alien status:—Neophyte species native to Tropical Asia, it can be considered casual alien in Italy. It is used as ornamental plant, especially the cultivars with variegated leaves (e.g., the cv. 'Joseph's coat').

Occurrence in Italy:—FVG, VEN, and CAM; formerly recorded in TAA, PIE, and EMR. Recently excluded from MAR, and LAZ (Iamonico 2008a, Iamonico *et al.* 2012).

Taxonomic annotations:—*Amaranthus tricolor* is a very variable species from the morphological point of view, both in vegetative (stem branching and leaf blade shape and colour), and in sexual characters (structure of the synflorescence). The high phenotypic variability led Linnaeus (1753, 1755, 1759b) to recognize several species, later reduced by Aellen (1959) to subspecies. A recent and detailed study on the Linnaean types (Iamonico 2014a) showed that all these names are to be treated as synonyms. The name *Amaranthus gangeticus* L. was often treated as synonym of *A. tricolor* (e.g., Townsend 1974, Kerguélen 1993, Bojian *et al.* 2003). However, according to Iamonico (2014b), Linnaeus' diagnosis and description are ambiguous and it was not possible to properly designate a lectotype or a neotype. Moreover, the name *A. gangeticus* cannot be rejected according to the ICN. So Iamonico (2014b) proposed to list this name as *incertae sedis*. The taxonomy of *A. tricolor* need further studies.

Specimina Visa Selecta:**—**ITALY. **Friuli-Venezia Giulia**: Trieste, sotto l'Orto Botanico dell'Università, 31 August 1963, *Poldini 23485* (TSB!); **Lombardia**: Como, Gravedona, October 1940, *Ceroni s.n.* (PAV!).

8–9. *Amaranthus blitum* aggregate.

General description:—Herbs monoecious, annual (therophyte). Stems prostrate-diffuse or ascending, glabrous, green to brown (sometimes reddish), branched. Leaves usually green, ovate, elliptic to rhombic, apex emarginate to bilobe, sometimes mucronate, base obtuse or cuneate, glabrous, petioled. Synflorescences arranged in axillary glomerules and/or terminal, spike- or panicle-like, brown at maturity. Floral bracts ovate, shorter than the perianth, acute, margin entire, glabrous. Staminate flowers with 3 tepals; stamens 3. Pistillate flowers with 3 tepals, ovate to lanceolate-linear; stigmas (2−)3. Fruit subglobse to ellipsoidal, indehiscent. Seed lenticular black, brownish-black or dark-reddish.

Taxa included (for Italy):—*Amaranthus blitum* L. with two varieties [var. *blitum* and var. *oleraceus* (L.) Hook.f.], and *A. emarginatus* Moq. ex Uline & Bray.

Taxonomic annotations:—Recent morphological and biometrical studies (Costea *et al.* 2001b, Walter & Dobes 2004, Iamonico & Iberite 2012) showed that the taxa included in this aggregate are quite different from the morphological point of view (characters of seed diameter and surface, leaf size, and fruit length). *Amaranthus blitum* and *A. emarginatus* have different origins, the first one being native to the Mediterranean area, Europe and North Africa, the second one to the Tropics. Today, these taxa are spread by man all over the world and the original distribution ranges are blurred. In order to reflect the different evolutionary histories, I prefer to recognize them at species rank, according to Hügin (1987). Concerning *A. oleraceus*, it has not a clear distribution area and probably originated from a human selection of *A. blitum.* It is often used as cultivated vegetable (see e.g., Costea *et al.* 2001b). Costea *et al.* (2001b) accepted it as a subspecies, but I prefer here to recognize this taxon at varietal rank, as already suggested by Hügin (1987).

1. Length of the fruit 1.9−3.5 mm; seed diameter 1.1−1.8 mm; leaf blade size (3.0−)3.5−9.0 × 1.5−6.2 cm .....7. *A. blitum*
- Length of the fruit (1.2−)1.4−1.8(−1.9) mm; seeds diameter 0.7−1.1 mm; leaf blade size 1−3.5(−4.5) × (0.5−)0.8−2.5 cm ..... 8. *A. emarginatus*

8. *Amaranthus blitum* L., Sp. Pl. 2: 990. 1753.

Type (lectotype designated by Filias *et al.* 1980: 149–150):—EUROPE. *Habitat in Europa temparatiore, Herb. Linn. No. 1117.14* (LINN!).

= *Amaranthus lividus* L., Sp. Pl. 2: 990. 1753, *nom. rejec.* (see Filias *et al.* 1980: 149–150). ≡ *Amaranthus lividus* proles *lividus* (Loisel.) Thell. in Asch. & Graebn. Syn. Mitteleur. Fl. [Ascherson & Graebner] 5: 274. 1914. Type (lectotype designated by Reveal & Jarvis, 2009: 978):—UNKNOWN ORIGIN. [Icon] "*Blitum pulchrum rectum magnum rubrum*" in Bauhin & Cherler (1651: 966).

= *Amaranthus ascendens* Loisel., Not. Fl. France 141. 1810. ≡ *Amaranthus blitum* var. *ascendens* (Loisel.) DC., Cat. Pl. Horti Monsp. 4. 1813. ≡ *Amaranthus lividus* proles *ascendens* (Loisel.) Thell. in Asch. & Graebn. Syn. Mitteleur. Fl. [Ascherson & Graebner]. 5(1(5)): 321(–322). 1914. ≡ *Amaranthus lividus* subsp. *ascendens* (Loisel.) Heukels, Geïllustreerde Schoolflora voor Nederland: 169. 1934.

Type (neotype designated by Iamonico 2015):—FRANCE. [Icon] "*Blitum majus*" from Dodonaei (1616: 617).

− *Amaranthus viridis sensu* Arcangeli (1882: 588, 1884: 207)

Description:—Herbs 1.5–8(–9) dm tall, monoecious, annual (therophyte). Stems usually ascending, glabrous, green to brown (sometimes reddish), branched. Leaves usually green, ovate, elliptic to rhombic [(3.0−)3.5−9.0 × 1.5−6.5 cm], sometimes with central dark spot, apex emarginate to bilobe, sometimes mucronate, base obtuse or cuneate, glabrous, petioled (petiole 1.0–4.0 cm long). Synflorescences terminal, spike-like, usually brown, (2.5−)4−10(−15) cm long. Floral bracts brownish or greenish, ovate [(0.4–)0.8–1.0 × 0.4−0.9 mm], shorter (⅓–½) than the perianth, acute, margin entire, glabrous. Staminate flowers with 3 tepals, usually ovate; stamens 3. Pistillate flowers with 3 tepals, lanceolate or linear, elliptic to obovate [(1.2−)1.4–2.0 × 0.5–1.1(−1.3) mm], with acute apex; stigmas (2−)3. Fruit reddish-brown to brown-yellowish, subglobose to elipsoidal (1.9−3.5 mm long) as long as or longer than the perianth (in this latter case the length < 2 times of the width), smooth or slightly rugose, indehiscent. Seed lenticular (see the diagnostic key of the varieties for the diameter), black, brownish-black or dark-reddish.

Iconography:—Beck (1909: Tab. 300).

Phenology:—Flowering from July to October.

Habitat:—Roadsides, river banks, cultivated land.

Elevation:—0–600 m a.s.l.

Chromosome number:—See varieties.

Chorology:—See varieties.

Occurrence in Italy:—All Italian regions (see varieties for details).

Taxonomic annotations:—Arcangeli (1882: 588, 1884: 207) did not report the name *A. blitum* L, but indicated *A. ascendens* Loisel. (now synonym of *A. blitum*) as synonym of *A. viridis* L. providing a description that corresponds well with the Linnaean and current concept of *A. blitum*.

Amaranthus blitum shows a high phenotypic variability (both in vegetative and in sexual characters) and several names (at subspecies, variety or form ranks) were published in the past, especially in the nineteenth century (see e.g., IPNI, 2008). As a consequence, misapplication of names and nomenlcatural disorder exsist. I here accept two varieties:

1. Seed with minutely punctiform surface and diameter 1.1–1.2 mm ..... var. *blitum*
- Seed with smooth surface and diameter (1.2−)1.4−1.7(–1.9) mm ..... var. *oleraceus*

8a. *Amaranthus blitum* subsp. ***blitum*** var. ***blitum*** (Fig. 10)

Chromosome number:—2n = 34 [Hügin 1986 from Germany, Queirós 1989 (sub *A. lividus*) from Portugal, Pobratova 2000 from Russia, Song *et. al.* 2002 (sub *A. lividus*), Sheidai & Mohammadzdeh 2008].

Chorology:—Native to Mediterranean area, and other parts of Europe (here sometimes introduced, see e.g., Akeroyd 1993). Alien in North America (Costea *et al.* 2001b, Mosyakin & Robertson 2003). Also recorded in Asia (Bojian *et al.* 2003, Iamonico & Das 2014).

Occurrence in Italy:—All Italian region, excluding VDA (see Iamonico & Bovio 2013 and literature cited) (indicated as alien in VEN, PIE, and UMB regions).

Specimina Visa Selecta:—ITALY. **Abruzzo**: Roseto, in arenosis maritimis, September 1949, *Zodda 5928* (FI!); **Basilicata**: Pascone, *s.d.*, *sine coll. s.n.* (FI!). **Campania**: in hortis al Sebeto, *s.d.*, *sine coll. s.n.* (RO!).

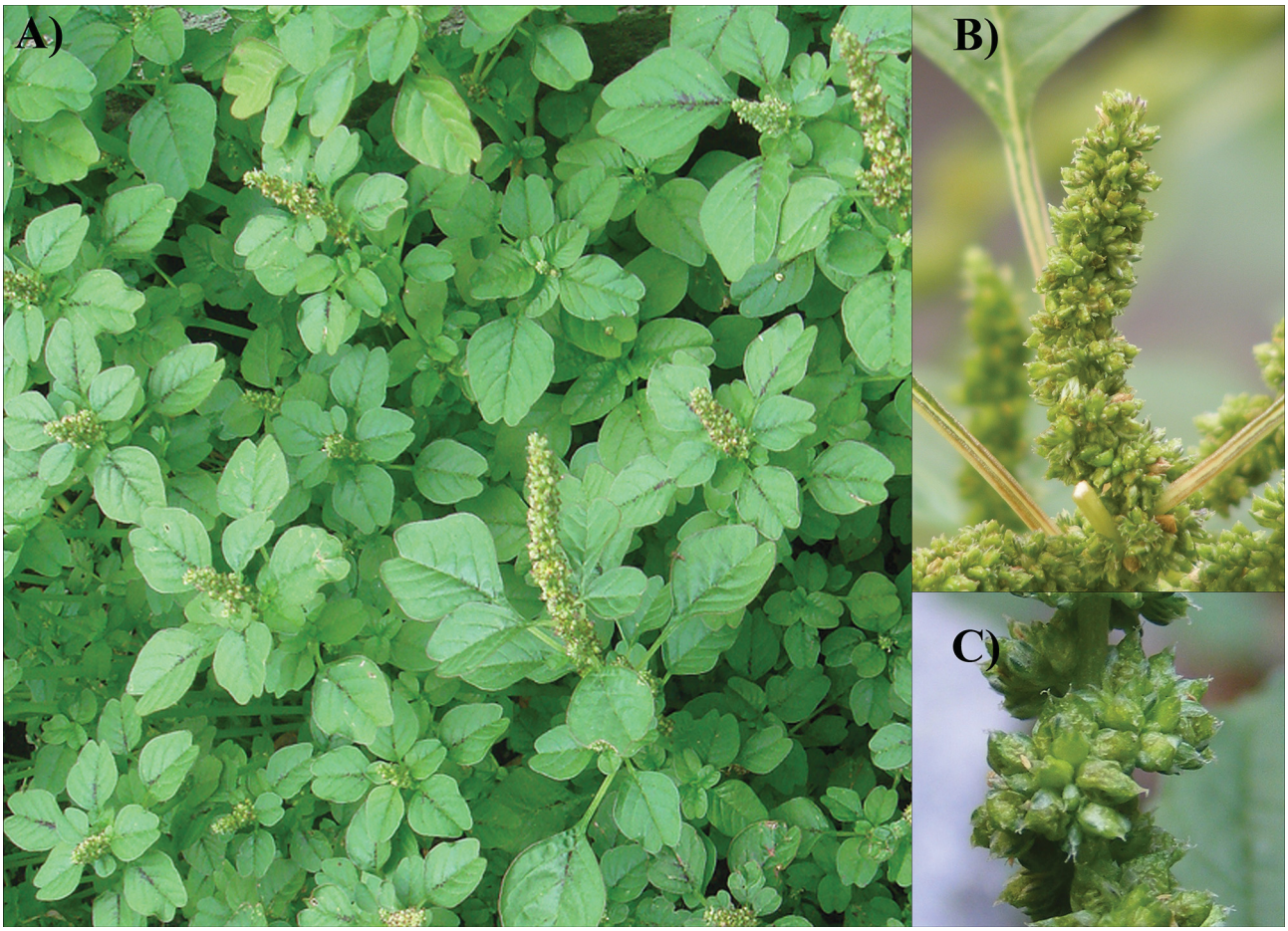

FIGURE 10. *Amaranthus blitum* var. *blitum* (Toscana, Firenze province, Fiesole locality, roadside): **A)** individual, **B)** synflorescence, **C)** detail of flowers (photos by D. Iamonico).

Emilia-Romagna: negli orti a casinalbo, September 1880, *sine coll. s.n.* (FI!); nei ruderi intorno a Modena, February 1881, *Gibelli s.n.* (FI!); in ruderatis circa Mutinam, 1885, *Gibelli s.n.* (FI!); Montefiorano, 800 m a.s.l., August 1934, *Mori s.n.* (FI!); Casinalbo, luoghi pingui, 70 m a.s.l., 8 August 1940, *Adr. Fiori s.n.* (FI!). **Lazio**: Frosinone, Casalvieri, località Murene, vigneto, orto, 25 October 1892, *Recchia s.n.* (RO!); Castelgandolfo, attorno al lago, September 1952, *Cacciato s.n.* (RO!); Roma, Centocelle, marrana, 30 August 1954, *Cacciato s.n.* (RO!); Roma, Centocelle, October 1956, *Anzalone s.n.* (RO!); Roma, binari del tram al ponte Casilino, 10 July 1957, *Cacciato s.n.* (RO!); Roma, in Via Policastro, 24 September 1957, *Cacciato s.n.* (RO!); Roma, Piazzale Clodio, October 1958, *Anzalone s.n.* (RO!); Roma, Via Labico, July 1959, *Cacciato s.n.* (RO!); Roma, Centocelle, 12 August 1961, *Cacciato s.n.* (RO!); *ibidem*, 21 September 1957 (RO!); Roma, marciapiede all' Acqua Bullicante, 18 August 1960, *Cacciato s.n.* (RO!); Roma, marciapiede sterrato lungo la Via Acqua Bullicante, 2 November 1960, *Cacciato s.n.* (RO!); Roma, pressi di Cinecittà, erbosi, dietro la chiesa di Don Bosco, 2 July 1964, *Cacciato s.n.* (RO!); Roma, tra le commessure del selciato su una gradinata del Tevere al Lungotevere Anguillara, 16 July 1964, *Cacciato s.n.* (RO!); Roma, in un campo di fagioli all'Acqua Bullicante, 12 August 1966, *Cacciato s.n.* (RO!); Roma, 2 August 1967, *Cacciato s.n.* (RO!); Roma, 12 September 1967, *Cacciato s.n.* (RO!); Roma, Cinecittà, 8 December 1970, *Cacciato s.n.* (RO!). **Lombardia**: nel Mantovano, *sine die*, *sine coll. s.n.* (FI!). **Liguria**: Lungo la strada a Langasco (Genova), 5 August 1970, *Catanzaro s.n.* (RO!); nei giaridni pubblici, Finale Ligure Marina (Savona), 23 August 1970, *Catanzaro s.n.* (RO!). **Marche**: Ponte della Zappa?, 24 August 1840, *sine coll. s.n.* (FI!); frequens in agro macerat., *s.d.*, *sine coll. s.n.* (FI!); Ripa, ponte della Zappa, 24 August 1940, *sine coll. s.n.* (FI!); frequens in agro macerat., *s.d.*, *Narducci s.n.* (FI!). **Molise**: Campomarino (Campobasso), interstizi della pavimentazione stradale, 27 July 2009, *Palermo et Iamonico s.n.* (HFLA!). **Piemonte**: Trontano, Cosasca (a valle del cimitero), 245 m a.s.l., campo abbandonato, 3 September 2001, *Antonietti s.n.* (*Herb. Antonietti*!); Montecrestese, deposito letame, 310 m a.s.l., 27 Septemebr 2002, *Antonietti s.n.* (*Herb. Antonietti*!).

Sardegna: Berchidda, Tamuri, prati umidi fangosi, 180−200 m, 17 September 2007, *Calvia s.n.* (*Herb. Calvia*!). **Sicilia**: Paternò, 15 September 1875, *Berénger s.n.* (PERU!); luoghi di ortaggi a Catania, *s.d.*, *sine coll. s.n.* (RO!). **Toscana**: San Concordio presso Lucca, August 1859, *sine coll. s.n.* (FI!); Firenze, nei campi presso S. Gervasio, September 1885, *Micheletti s.n.* (PERU!); Isola del Giglio, 20 May 1894, *Sommier s.n.* (FI!); incolto erboso nel centro di Massa (Massa), 70 m a.s.l., 7 September 2006, *Marchetti 34196* (APP!). **Trentino-Alto Adige**: Tirol. merid. Trento, 3 September 1881, *Gehu s.n.* (FI!). **Veneto**: in un campo a Cozzuolo (Vittorio), 29 July 1895, *Pampanini s.n.* (FI!); Belluno, Valle di Cadore, spianata ex baraccamenti, 23 August 1921, *Ugolini 9540/3* (PAD!); Belluno, Villa di Sedico, orti, 3 August 1984, *Argenti 9838/4* (*Herb. Argenti*!).

8b. *Amaranthus blitum* subsp. ***blitum*** var. ***oleraceus*** (L.) Hook.f., Fl. Brit. India [J.D. Hooker] 4: 721. 1885 (Fig. 11).

Basionym: *Amaranthus oleraceus* L., Sp. Pl., ed. 2. 2: 1403. 1763.
≡ *Amaranthus lividus* proles *oleraceus* (L.) Thell. in Asch. & Graebn., Syn. Mitteleur. Fl. [Ascherson & Graebner] 5(1(5)): 321. 1914.
≡ *Amaranthus blitum* subsp. *oleraceus* (L.) Costea in Costea & al., Sida 19(4): 984. 2001.
Type (lectotype designated by Filias *et al.* 1980: 150):—ASIA. *Habitat in India, Herb. Linn., No. 1117.13* (LINN!).

Chromosome number:—Unknown.

Alien status:—The origin of this taxon remains uncertain at present. It probably originated from a selection of the var. *blitum* and was used as cultivated vegetable (see e.g., Costea *et al.* 2001b). However, it does not appear to have been used for this purpose in Italy. The Italian population was certainly indroduced casually (roadsides habitat), not cultivated.

Occurrence in Italy:**—**PIE (Iamonico & Sánchez Del Pino 2012).

Specimina Visa Selecta:**—**ITALY. **Piemonte**: Torino, Corso Inghilterra, roadsides, 9 August 2007, *Tisi s.n.* (TO!).

9. *Amaranthus emarginatus* Moq. ex Uline & Bray, Bot. Gaz. 19: 319. 1894.

≡ *Amaranthus blitum* L. subsp. *emarginatus* (Moq. ex Uline & Bray) Carretero, Muñoz Garmendia & Pedrol, Anales Jard. Bot. Madrid 44(2): 599. 1987.
Type (lectotype designated by Hügin 1987: 461):—DOUBTFUL ORIGIN. "*Amaranthus polygonoides L. ?*", 1842−44 *Zollinger 1646* (P!, isolectotype: G-00098622!).
= *Amaranthus polygonoides* Zoll. ex Moq., Prodr. [A. P. de Candolle] 13(2): 274. 1849, *nom. illeg.* non Linnaeaus (1759a: 27) (Art. 53.1 of the ICN). ≡ *Amaranthus blitum* subsp. *polygonoides* (Zoll. ex Moq.) Carretero, Anales Jard. Bot. Madrid 41(2): 276. 1985. ≡ *Amaranthus emarginatus* Salzm. ex Moq., Prodr. [A. P. de Candolle] 13(2): 274. 1849, *nom. illeg.* (art. 34.1c of the ICN). = *Euxolus viridis* (L.) Moq. var. *polygonoides* Moq., Prodr. [A. P. de Candolle] 13(2): 273−274. 1849.

Description:—Herbs 1.5–8 dm tall, monoecious, annual (therophyte). Stems prostrate-diffuse or ascending, glabrous, green to brown (sometimes reddish), branched. Leaves usually green, elliptic to rhombic (see the diagnostic key of the varieties for the sizes), apex emarginate to bilobe, usually mucronate, base cuneate, glabrous, petioled (petiole about as long as the blade). Synflorescences arranged in axillary glomerules or terminal, spike-like, usually brown, up to 10(−12) cm long. Floral bracts, greenish, ovate [(0.3–)0.7–0.9(–1.0) × 0.3−0.8 mm] shorter (⅓−½) than the perianth, acute, margin entire, glabrous. Staminate flowers with 3 tepals, ovate to lanceolate; stamens 3. Pistillate flowers with 3 tepals, ovate to lanceolate-linear [(1.0−)1.2–1.8 × 0.5–1.0(−1.2) mm], with acute apex; stigmas (2−)3. Fruit usually brownish, subglobose to ellipsoidal [(1.2−)1.4−1.8(−1.9) × (1.0−)1.2−1.5(−1.7) mm], as long as or sligthly longer than the perianth, slightly rugose, indehiscent. Seed lenticular (0.7−1.1 mm in diameter), black, brownish-black or dark-reddish.

Chromosome number:—2n = 34 (Hügin 1986 from Germany, Walter & Dobes 2004 from Austria, Sheidai & Mohammadzdeh 2008).

Alien status:—Neophyte species native to Tropical America, it can be considered naturalized in Italy. No evident impacts were observed so far.

FIGURE 11. *Amaranthus blitum* var. *oleraceus*: exsiccatum from Torino city (Piemonte) preserved at TO.

Occurrence in Italy:—This taxon was recorded neither in comprehensive Italian floras [from Bertoloni (1854) to Pignatti (1982)], nor by recent checklists (Conti *et al.* 2005, 2007, Celesti-Grapow *et al.* 2009, 2010a, 2010b). Despite this, it was certainly present in Italy and indicated as naturalized [in TAA (Wilhalm *et al.* 2004, Iamonico 2008, Bertolli & Prosser 2012) and EMR (Ardenghi & Rossi 2012)], or casual [VEN (Iamonico 2009i, 2010d, 2012c), LOM (Iamonico 2012d), PIE (Iamonico *et al.* 2010b), VDA (Iamonico & Bovio 2010, 2013), LIG (Iamonico 2013a), TOS (Iamonico 2012b, Iamonico & al. 2013), UMB (Iamonico 2012d), LAZ (Iamonico 2008a), CAM (Iamonico 2012b), BAS (Iamonico 2009i), SAR (Iamonico & Calvia 2011)]. Old records were published for ABR (Iamonico 2010d).

Taxonomic annotations:—On the basis of the habitus, the leaf size and the synflorescence arrangement, two morphotypes can be distinguished (var. *emarginatus*, and var. *pseudogracilis* Thell.). Costea *et al.* (2001b: 981) proposed varietal rank for Thellung's taxon, while Hügin (1987) accepted it at subspecies rank. The appropriate rank of these taxa requires further investigation (Costea *et al.* 2001b, Walter & Dobes 2004, Iamonico & Iberite 2012). It seems that they have different ecological preferences, related to the capability to endure water stress (see e.g., Walter & Dobes 2004). However, further analyses are needed to verify this hypothesis. I here provisionally accept the varietal rank, according to Iamonico (2015).

1. Stems ascending; leaf size (1.0−)2.0−3.0 × (0.5−)1.0−1.5 cm; synflorescence in axillary glomerules or short and thickened terminal spike-like (up to 2 cm long) ..... var. *emarginatus*
- Plants prostrate; leaf size (2.0−)3.0−4.0(−4.5) × (1.2−)1.5−2.5 cm; synflorescence in terminal long and slender spike-like (up to 12 cm long), often thin and flexuous (1.5−7.5 cm long) ..... var. *pseudogracilis*

9a. *Amaranthus emarginatus* subsp. ***emarginatus*** var. ***emarginatus*** (Fig. 12).

≡ *Amaranthus blitum* L. subsp. *emarginatus* (Moq. ex Uline & Bray) Carretero, Muñoz Garm. & Pedrol var. *emarginatus*

Occurrence in Italy:—PIE, VDA (Iamonico & Bovio 2010, 2013), LOM (Iamonico 2012d), VEN (Iamonico 2009i, 2012c), UMB (Iamonico 2012c), LAZ (Iamonico 2008a, Bertolli & Prosser 2012), CAM (Iamonico 2012b), and SAR (Iamonico & Calvia 2011); formerly recorded in TOS (Iamonico 2012b) and ABR (Iamonico 2010d).

Specimina Visa Selecta:—ITALY. **Abruzzo**: Lungo il fiume Liri presso Civitella Roveto, 5 June 1900, *Pappi s.n.* (RO!). **Campania**: dintorni di Napoli, *s.d.*, *coll. illeg. s.n.* (RO!); Marina di Camerota, bordi di vie, 11 August 2009, *Iamonico s.n.* (HFLA!); Marina di Camerota, zona porto, margini stradali, 15 August 2009, *Iamonico s.n.* (HFLA!). **Lazio**: Formia, sul littorale di Castellone, June 1821, *Fiorini-Mazzanti s.n.* (RO!); Roma, 14 July 1954, *Cacciato s.n.* (RO!); Roma, marciapiede in Via Giovanni Giolitti, pressi di Porta Maggiore, 20 August 1957, *Cacciato s.n.* (RO!); Roma, Cinecittà, 12 July 1964, *Cacciato s.n.* (RO!); Roma, tra le commessure del selciato su una scalinata del Tevere al Lungotevere Anguillara, 16 July 1964, *Cacciato s.n.* (RO!); Lago di Canterno (Fiuggi), 11−16 Septemebr 1978, *Anzalone s.n.* (RO!); Roma, quartiere appio Claudio, Via Arco di Travertino, bordi di vie, 40 m a.s.l., 23 July 2007, *Iamonicos.n.* (HFLA!). **Lombardia**: Mantova, Bosco Fontana, strada est lungo i prati della palazzina, 30 July 1977, *Barini s.n.* (FI!); *ibidem*, 4 October 1977 (FI!). **Sardegna**: Olbia-Tempio, Oschiri-Berchidda, Balanotti, prati aridi e pietraie presso le sponde lacustri, 160−164 m a.s.l., 6 August 2010, *Calvia s.n.* (FI!, HFLA!, *Herb. Calvia*!); Olbia-Tempio, Oschiri-Berchidda, Coguto, prati aridi e pietraie presso le sponde lacustri, 160−164 m a.s.l., 6 August 2010, *Calvia s.n.* (FI!, HFLA!, *Herb. Calvia*!). **Toscana**: Firenze, Vallombrosa nel cortile dell'Istituto, September 1902, *Adr. Fiori s.n.* (FI!); *ibidem* (FI!). **Piemonte**: Verbania, a valle ponte 205, riva sbb. Del Toce, 195 m a.s.l., 22 October 2003, *Antonietti s.n.* (*Herb. Antonietti*!); Verbania Feriola, riva sin. Stronetta, sabbie, 4 November 2003, *Antonietti s.n.* (*Herb. Antonietti*!); Gravellona Toca, foce T. Strona, alveo ciottoloso, 197 m a.s.l., 20 October 2009, *Antonietti s.n.* (*Herb. Antonietti*!). **Umbria**: lungo la strada vicino a Bevagna, 27 July 1864, *sine coll. s.n.* (FI!); Terni, via Gianbattista Vico, bordi di vie, 131 m a.s.l., 3 September 2011, *Iamonico s.n.* (HFLA!). **Valle d'Aosta**: Pont-Saint-Martin, sul ponte romano, 365 m a.s.l., 15 September 1993, *Bovio s.n.* (AO!); Saint-Pierre, nelle vigne del Mont Torrette, 840 m a.s.l., 28 September 2006, *Bovio, Gerard. et Poggios.n.* (*Herb. Bovio*!). **Veneto**: Venezia, 31 January 1928, *Salutes.n.* (FI!); Mutten di Feltre, 7 September 1978, *Lasen 9937/2* (*Herb. Lasen*|); Cavarzano, ruderale, 7 August 2009, 400 m a.s.l., *Argenti 9839/1* (*Herb. Argenti*!).

FIGURE 12. *Amaranthus emarginatus* var. *emarginatus*: **A)** individual (Campania, Salerno province, Marina di Camerota locality, walkway), **B)** synflorescence, **C)** detail of flowers (Umbria, Perugia province, San Feliciano locality, disturbed area) [photos by D. Iamonico (**A**), and A. Moro (**B**–**C**)].

9b. *Amaranthus emarginatus* subsp. ***emarginatus*** var. ***pseudogracilis*** (Thell.) Iamonico, Pl. Biosystems: in press. 2015 (Fig. 13).

Basionym: *Amaranthus lividus* L. proles *polygonoides* f. *pseudogracilis* Thell., Syn. Mitteleur. Fl. [Ascherson & Graebner] 5: 321. 1914.

≡ *Amaranthus emarginatus* subsp. *pseudogracilis* (Thell.) Hügin, Willdenowia 16: 463. 1987.

≡ *Amaranthus blitum* subsp. *emarginatus* (Moq. ex Uline & Bray) Carretero, Muñoz Garm. & Pedrol var. *pseudogracilis* (Thell.) Costea in Costea & al., Sida 19(4): 981. 2001.

Type (lectotype designated by Iamonico 2015):—GERMANY. Mecklenburg-Vorpommern: *im Botanischen Garten Strasburg [Uckermark]*, 8 August 1904, *Ludwig 12130* (B-10-0261513!).

Iconography:—Carretero (1990: 568, Lám. 171a–f).

Occurrence in Italy:—PIE, VEN (Iamonico 2010d, 2012c), TAA, LIG (Iamonico 2013a), EMR (Ardenghi & Rossi 2012), TOS (Iamonico & al. 2013), LAZ (Iamonico 2008a), BAS (Iamonico 2009i).

Specimina Visa Selecta:—ITALY. **Basilicata**: Maratea (Potenza), loc. Ondavo, margine della via principale (UTM: WE 61.27), lungo il marciapiede, 12 august 2008, *D. Iamonico s.n.* (HFLA!). **Emilia-Romagna**: Alfonsine (Ravenna), Strada Provinciale Destra Senio-Molinazza (S.P. 105), Riserva Naturale e SIC "stagno di Fornace Violani", lato NE, verso gli edifici della cooperativa muratori, prato umido a margine di stagno (ex cava d'argilla) e canneto, 14 July 2012, *Rossi s.n.* (FI!). **Lazio**: Ciampino, via Guidoni, 31 July 2009, *Iamonico s.n.* (HFLA!). **Liguria**: Bergeggi (Savona), lungo il litorale, 7 August 1970, *Catanzaro s.n.* (RO!). **Piemonte**: Verbania, 195 m a.s.l., terreno sabbioso, 22 October 2003, *Antonietti s.n.* (*Herb. Antonietti*!); Saluggia, Fraz. S. Antonio, bordo strada, 11 August 2008, *Tisi 186-4b* (TO!). **Toscana**: Livorno, marciapiede, 14 m a.s.l., August 2011, *Lazzeri*, *Mazzoncini* et *Sammartino s.n.* (*Herb. Museo di Storia Naturale del Mediterraneo di Livorno*!). **Trentino-Alto Adige**: Südtirol, 6 km ESE Bruneck (Brunico), unmittelbar W v. Nasen, Straßenrand, Misthaufen, 6 August 1994, *Tribsch 2539* (W!). **Veneto**: Cusighe di Belluno, ruderale, 15 August 2008, *Argenti 9839/1* (*Herb. Argenti*!);

Belluno, P.le Resistenza, selciato, 390 m a.s.l., 22 August 2009, *Argenti 9839/3* (*Herb. Argenti*!); Ospitale di Cadore, incolti, 540 m a.s.l., 23 September 2009, *Argenti 9639/4* (*Herb. Argenti*!); Sottocastello di Pieve di Cadore, orti, 700 m a.s.l., 14 October 2009, *Argenti 9540/3* (*Herb. Argenti*!).

FIGURE 13. *Amaranthus emarginatus* var. *pseudogracilis* (Lazio, Roma province, Ciampino locality, walkway): **A)** individual, **B)** synflorescence, **C)** detail of flowers (photos by D. Iamonico).

10. *Amaranthus graecizans* L., Sp. Pl. 2: 990. 1753.

Type (lectotype designated by Fernald 1945: 139):—U.S.A. *Habitat in Virginia, Herb. Clayton No. 442* (BM-000051563!).
= *Amaranthus angustifolius* Lam., Encycl. [J. Lamarck & al.] 1: 115. 1783, *nom. illeg.* Art. 52.2[1] of the ICN (McNeill *et al.* 2012).

Description:—Herbs 1–8 dm tall, monoecious, annual (therophyte). Stems erect or ascending, ± glabrous (sometimes sparsely pubescent in the distal region), pale to black-brown to reddish, usually branched. Leaves usually green, ovate-rhomboidal to lanceolate (decreasing in size towards stem apex), with entire margins, apex acute or obtuse, sometimes mucronate, base cuneate, glabrous, petioled [petiole (1.0–)2.0–5.0(–6.0) cm long]. Synflorescences arranged in axillary glomerules, often reddish. Floral bracts brown-yellowish, lanceolate (1.2–2.0 × 0.3−0.6 mm) as long as or shorter than the perianth, acute, margin entire, glabrous. Staminate flowers with 3 tepals, ovate to lanceolate; stamens 3. Pistillate flowers with 3 tepals, ovate-lanceolate [(1.3–)1.5–2.0 × 0.4–0.7 mm], with acute, and often mucronate apex; stigmas 3. Fruit brown, subglobose [(1.5–)2.0–2.5(–2.7) × (1.0–)1.4–1.5(–1.8) mm], longer than the perianth, rugose, dehiscent. Seed lenticular [1.0–1.3(–1.5) mm in diameter], black to dark-brown.

Phenology:—Flowering from July to September.

1. *Amaranthus angustifolius* was described citing among synonyms an earlier legitimate name (*A. graecizans* L.).

Habitat:—Uncultivated land, roadsides, backfills, pebbly beaches.

Elevation:—0–1000 m a.s.l.

Chromosome number:—2n = 32 (Carretero 1984 from Spain, Paiva & Leitao, 1989, Queirós 1989 from Portugal, Sheidai & Mohammadzdeh 2008).

Chorology:**—**Paleotemperate taxon native to Europe, Central-Western Asia, and Northern Africa (Carretero 1990, Akeroyd 1993, Boulos 1999, Ghafoor *et al.* 1977, Fennane & Tatou 2005, Le Floc'h *et al.* 2008), it is considered introduced in some European countries (see e.g., Pyšek *et al.* 2002), and in North America (Mosyakin & Robertson 2003). Concerning Italy, although Celesti-Grapow *et al.* (2009a, 2009b, 2010) treated *A. graecizans* as alien species, all other Italian authors (e.g., Fiori 1923, Pignatti 1982, Conti *et al.* 2005) considered it as native. I agree with the latter authors.

At subspecific rank (see Taxonomic annotations) two main distribution areas can be distinguished. The first area includes Central and southern Europe plus North Africa [subsp. *graecizans* and subsp. *sylvestris* (Vill.) Brenan], the second one is in eastern Europe (Russia and adjacent territories) plus Central and southern Asia [subsp. *aschersonianus* (Thell.) Costea and subsp. *thellungianus* (Nevski) Gusev]. Ongoing biogeographic and morphometric studies (see also Iamonico 2014c) have the aim to define the relationship among these taxa and clarify their identities.

Occurrence in Italy:**—**All Italian regions (Iamonico 2014c), excluding VDA (see Iamonico & Bovio 2013 and literature cited); formerly recorded in TAA (Iamonico & Wilhalm 2008).

Taxonomic annotations:**—**Fernald's type choice of a Clayton collection (Fernald 1945: 139) appears to be the earliest, although many subsequent authors have followed Fernandes (1957: 191) in accepting the sheet No. 1117.3 (LINN) as the type.

The morphological characters of stem hairiness, leaf blade shape (lanceolate or ovate-rhomboidal), petiole length, synflorescence structure (with or without terminal synflorescence), bract and tepal apex (acute/mucronate or awned), seed angle (obtuse or acute), and fruit (dehiscent/indehiscent) were interpreted recognizing four subspecies (subsp. *graecizans*, subsp. *sylvestris*, subsp. *aschersonianus*, subsp. *thellungianus*, see e.g., Costea 2003). According to Iamonico (2014c) specimens collected in Italy and identifiable as *A. graecizans* are all referable to subsp. *sylvestris*. However, since Fiori (1923: 433) and Pignatti (1982: 181) also indicated *A. graecizans* s.s., I prefer to provide a diagnostic key for both subspecies (*graecizans* and *sylvestris*). The occurrence in Italy of the nominal subspecies need verification and may be possible in north-eastern Italy:

1. Leaf blade lanceolate [(2.0−)3.0−5.0(−6.0) × 0.5−1.0 cm], ratio length/width of the blade 3.0−6.0..... subsp. *graecizans*
- Leaf blade ovate-rhomboidal [5.0−6.0 × 2.5−3.0(−3.5) cm], ratio length/width of the blade 1.8−2.2 ..... subsp. *sylvestris*

10a. *Amaranthus graecizans* L. subsp. ***graecizans***

Iconography:**—**Beck (1909: Tab. 299, figures 1−7, sub *A. angustifolius*).

Occurrence in Italy:**—**Doubtful in VEN (Pignatti 1982: 181, Iamonico 2014c).

10b. *Amaranthus graecizans* L. subsp. ***sylvestris*** (Vill.) Brenan, Watsonia 4: 273. 1961 (Fig. 14)

Basionym: *Amaranthus sylvestris* Vill., Cat. Pl. Jard. Strasb. 111. 1807.
≡ *Amaranthus sylvestris* Desf. ex Poiret, Tabl. École Bot.: 44. 1804, *nom. nud.*, *nom. inval.* (Art. 38.2 Ex.1 of the ICN).
≡ *Amaranthus graecizans* var. *sylvestris* (Desf.) Asch., Beitr. Fl. Aethiop.: 176. 1867, *comb. illeg.*
≡ *Amaranthus graecizans* subsp. *sylvestris* (Vill.) O.Bolòs & Vigo, Butl. Inst. Catalana Hist. Nat., Secc. Bot. 38(1): 89. 1974.
≡ *Amaranthus angustifolius* proles *sylvestris* (Vill.) Thell., Syn. Mitteleur. Fl. [Ascherson & Graebner] 5(1(5)): 300. 1914.
≡ *Amaranthus angustifolius* subsp. *sylvestris* (Vill.) Heukels, Geïllustreerde Schoolflora voor Nederland: 170. 1934.
Type (lectotype designated by Townsend 1985: 31):—*Herb. Tournefort 1849* (P!).

Iconography:—Willdenow (1790: Tab. VIII, fig. 16 sub *A. viridis*), Maundu & Grubben (2004).

Occurrence in Italy:—FVG, VEN, LOM, PIE, LIG, EMR, TOS, MAR, UMB, LAZ, ABR, MOL, CAM, PUG, BAS, CAL, SIC, SAR; formerly recorded in TAA (Iamonico & Wilhalm 2008, Iamonico 2014c).

Specimina Visa Selecta:—ITALY. **Abruzzo**: in agri derelictis prope Alasso? D'Alba ad...Montis Velino, 10 August 1825, *Levier s.n.* (FI!); Villavallelonga, nell'orto, 20 August 1903, *Grande s.n.* (FI!); nei pressi del Piomba

(Atri), Incolti umidi, 100 m a.s.l., 24 Septemebr 2009, *Bartolucci & Iocchi 38279* (APP!). **Basilicata**: in campis lucaniae, Muro, September 1859, *sine coll. s.n.* (FI!); Potenza, Montereale, in arvis solo argillosis, 890 m a.s.l., 6 October 1924, *Gavioli s.n.* (FI!); Potenza ad vias prope urbe, 20 Septemebr 1928, *Gavioli s.n.* (FI!). **Calabria**: Fiumarella (Catanzaro), 27 September 1893, *Adr. Fiori s.n.* (FI!); Laino Borgo, orti a S. Francesco, 19 September 1900, *Longo s.n.* (RO!); Cosenza, Cetraro, stazione Antica damperia, 40 m a.s.l., 26 September 1991, *Crusco 1056* (CLU!); Tropea, staz. ferroviaria, 29 September 2007, *Iamonico s.n.* (HFLA!). **Campania**: Pompei, October 1846, *sine coll. 90947* (PAL!); in cultis Napoli, *s.d.*, *sine coll. s.n.* (FI!); paludi presso il Sebeto, *s.d.*, *Lusina s.n.* (RO!); Marina di Camerota, Cala Bianca, sabbia ciottolosa, 13 August 2009, *Iamonico s.n.* (HFLA!). **Emilia-Romagna**: dintorni di Faenza, 26 August 1862, *Cicioni s.n.* (FI!); Colli di Faenza, October 1882, *Caldesi 90946* (PAL!); tra i ruderi attorno a Modena, 6 July 1883, *Adr. Fiori s.n.* (FI!); Colli di Faenza, 29 October 1887, *Caldesi s.n.* (FI!). **Lazio**: Roma, margini delle strade (macerie e sterrati) presso Viale Tiziano e Lungotevere di P. Milvio, 18 June 1932, *Montelucci s.n.* (RO!); Guidonia, strade e macerie, 19 October 1941, *Montelucci 58853* (RO!); Roma, sui prati umidi di Centocelle, 31 July 1957, *Cacciato s.n.* (FI!); presso Subiaco (Santa Scolastica), 25 September 1961, *Anzalone s.n.* (RO!); Roma, 28 April 1964, *sine coll. s.n.* (FI!); Isola di Ventotene, 24 September 1967, *Anzalone s.n.* (RO!); Isola di Ponza, presso l'abitato a zona M. Guardia, 29 September 1967, *Anzalone s.n.* (RO!); San Felice Circeo, spiaggia, 10 September 1968, *Cacciato s.n.* (FI!); Lago di Bracciano (Trevignano), September 1976, *Anzalone s.n.* (RO!); Roma, Lungotev. Delle Vittorie, June 1977, *Anzalone s.n.* (RO!); oltre foce Aniene, a monte (riva sin.) July 1978, *Anzalone s.n.* (RO!); Roma, Fosso Magliana, Semptember 1981, *Anzalone s.n.* (RO!), Roma, cantieri e luoghi incolti nei pressi del Centro Commerciale EUROMA, 19 July 2008, *Iamonico s.n.* (HFLA!). **Liguria**: sull'alveo del fiume al Lungo Bisogno, a Genova, 15 October 1955, *Lusina s.n.* (RO!). **Lombardia**: nel Mantovano, March 1842, *Barbieri s.n.* (FI!); lungo le sponde del fiume Po alla confluenza col Ticino, 15 July 1969, *Catanzaro s.n.* (RO!). **Marche**: cresce lungo i binari nei pressi dell'Agnone, ferr. di Senigallia presso il mare, *s.d.*, *Bettini s.n.* (FI!); Marche negli orti, 1830, *Marzialetti s.n.* (FI!); Tolentino, hortis...cultis, August 1899, *Ricci s.n.* (FI!); Ripe, nell'orto, 31 August 1933, *Fiori s.n.* (FI!); Pioraco, August 1954, *sine coll. s.n.* (RO!); Ascoli Piceno, Ist. Tec. Agr., July 1955, *Anzalone s.n.* (RO!); Pioraco, August 1956, *Anzalone s.n.* (RO!); Pesaro presso la Polveriera Vecchia, luoghi erbosi incolti, suolo prevalentemente argilloso, 11 October 1964, *Brilli-Cattarini 2595* (PESA!); dintorni di Chiaravalle nell'alveo dell'Esino tra il Ponte ferroviario e il ponte autostradale, depositi alluvionali ghiaioso-limosi, suolo prevalentemente argilloso-calcareo, humus nullo, 13 September 1985, *Brilli-Cattarini et Gubellini 2593* (PESA!); dintorni di Pesaro presso Muraglia, campi incolti, suolo prevalentemente argilloso-sabbioso, humus nullo, 1 August 1990, *Brilli-Cattarini 2592* (PESA!); San Benedetto del Tronto, Sentina, ambienti ruderali e incolti, 0−10 m a.s.l., 27 July 2009, *Conti 39478* (APP!); *ibidem*, 19 Septemeber 2009, *Conti 39480* (APP!); Provincia di Ancona, bordo via verso la spiaggia Mezzavalle, 12 August 2010, *Iamonico* (HFLA!). **Piemonte**: Bornasco (Cuneo), nei campi, 12 September 1911, *Zola s.n.* (FI!); Torino, Corso Marsiglia tra la cinta dell'«Itala» e la ferrovia, 29 July 1929, *Zola s.n.* (FI!). **Puglia**: Barletta, 1844, *Bruni s.n.* (FI!); Canosa, 1844, *Bruni s.n.* (FI!); Lecce, Viale Lo Re, marciapiede, 16 July 1996, *Mele & Annese s.n* (LEC!); Bari, aiuole davanti il McDonald, 4 July 2007, *Iamonico s.n.* (HFLA!). **Sardegna**: Carbonia Iglesias, Su Pranu-S. Antioco, 2 August 1976, *Milia et Mossa* (CAG!). **Sicilia**: Catania, 1 May 1829, *sine coll. 59053* (PAL!); Messina, Mirto, September 1831, *sine coll 79895* (PAL!); Termini, September 1851, *sine coll. 59058* (PAL!); Messina a Trapani nei campi, 11 september 1868, *sine coll. s.n.* (FI!); Insula Linosa, 1906, *Martii s.n.* (FI!); Pantelleria (Kamma), August 1959, *Catanzaro s.n.* (RO!); lungo il margine della strada per Castelvetrano, Mazara del Vallo, contrada Ramo, 4 October 1969, *Catanzaro s.n.* (RO!); Palermo, in arvis, *s.d.*, *Todaro s.n.* (RO!); *ibidem*, *Todaro s.n.* (FI!); Caltanissetta, May 1984, *sine coll. s.n.* (RO!); nei dintorni di Serignano e Camporeale, 20 September 1990, *Certa & Ilardi 79674* (PAL!); Ustica, *sine die*, *Messina 59054* (PAL!). **Toscana**: resso Lucca la mercato nuovo presso il ponte di monte di Vico, August 1860, *Beccari s.n.* (FI!); Pontevecchio nei campi, 16 October 1867, *sine coll. s.n.* (FI!); Bagni di Lucca, ad vias, 20 September 1872, *sine coll. s.n.* (FI!); Pisa, negli orti e prati incolti di Casciano, 10 August 1886, *Berénger s.n.* (PERU!); Bagni di Lucca, ad vias, 20 September 1892, *sine coll. s.n.* (FI!); Isola del Giglio, 27 September 1894, *Sommier s.n.* (FI!); Insula Elba, tra Procchio e Campo verso Literno, 20 July 1900, *Sommier s.n.* (FI!); Insula Elba, Marciana Marina, in culti vulgatus, 17 July 1906, *Sommier s.n.* (FI!); Arezzo, margini di campi, 4 September 1909, *Savelli s.n.* (FI!); Firenze-Cascine, alluvione, 43 m a.sl., 15 July 1914, *Adr. Fiori s.n.* (FI!); Arezzo, campi presso Agazzi, 12 August 1934, *Montelucci s.n.* (RO!); Firenze, nei campi presso Gervasio, September 1885, *sine coll. s.n.* (PERU!); Rignano sull'Arno, nell'orto della Pieve, nelle macerie insieme ad altri amaranti (*A. deflexus*, *A. retroflexus*), 1 October 1944, *Montelucci s.n.* (RO!); Maremma Grossetana, Tenuta

Acquisiti, dintorni dell'abitato, 20−25 July 1946, *Corradi s.n.* (FI!). **Trentino-Alto Adige**: in Tirolo calidiore, *s.d.*, *Ambrosi s.n.* (FI!). **Umbria**: Perugia (Prigneto), October 1886, *Cicioni s.n.* (PERU!); Trasimeno, all'Is. Maggiore, 22 July 1887, *Cicioni s.n.* (PERU!); Monte Subasio, 10 October 1887, *Cicioni s.n.* (PERU!); Monte Subasio, 10 October 1887, *Pirola 3609* (CAT!); Città di Perugia, 22 July 1889, *Coccitrini 3609* (CAT!); comune di Perugia, 1 August 1898, *coll. illeg. s.n.* (FI!); Monte Falco a S. Fortunato, 17 August 1908, *Cicioni s.n.* (PERU!). **Veneto**: Veneto, in hortis et cultis, September 1881, *Goiran s.n.* (FI!); Conegliano, June 1887, *sine coll. s.n.* (RO!); negli orti presso Padova, October 1896, *Adr. Fiori s.n.* (FI!); campo a Pinidello (Cordignano), 78 m a.s.l, 6 September 1899, *Pampanini s.n.* (FI!); San Pietro al Natisone, 10 November 1901, *Minio s.n.* (FI!); Tai di Cadore, macerie, 16 Semptember 1922, *Ugolini 9540/3* (PAD!).

FIGURE 14. *Amaranthus graecizans* subsp. *sylvestris* (Marche, Macerata province, La Rancia locality, uncultivated land): **A)** individual, **B)** synflorescence, **C)** detail of flowers (photos by D. Carbini).

11. *Amaranthus blitoides* S.Watson, Proc. Amer. Acad. Arts 12: 273. 1877 (Fig. 15).

Type (lectotype designated by Fernald 1945: 139):—U.S.A. Iowa: Ames, gravelly or sandy soils especially around buildings and along roads, *Bessey s.n.* (GH!).

Description:—Herbs 1–5 (rarely up to 10) dm tall, monoecious, annual (therophyte). Stems prostrate-ascending, glabrous (rarely sparsely pubescent), pale brown to reddish, branched. Leaves usually green (sometimes with a central withish spot), oblong-lanceolate to obovate-spathulate [1.5−3.0(−5.0) × (0.4−)0.5−1.0(−2.0) cm], sometimes fleshy, with entire or undulate margins, apex acute or rounded, often mucronate, base cuneate, glabrous,

with marginal white vein, petioled (petiole 0.5–1.5 cm long). Synflorescences arranged in axillary glomerules, reddish or green. Floral bracts, green or greenish, ovate to lanceolate (1.3–3.0 × 0.4−0.7 mm), shorter than the longest perianth segments, acute, margin entire, glabrous. Staminate flowers with 3(−4) tepals, ovate to lanceolate; stamens 3. Pistillate flowers with (4−)5 unequal tepals, lanceolate, elliptic [the greater 1.5–2.5(–3.5) × (0.7–)1.0–1.2 mm], with acute to acuminate, and mucronate apex; stigmas 3. Fruit brown or reddish, ellipsoidal (2.0–2.2 × 1.0–1.4 mm), as long as or longer than the tepals, usually smooth, dehiscent. Seed lenticular (1.5–1.7 mm in diameter), black.

Iconography:—Mosyakin & Robertson (2003).

Phenology:—Flowering from July to September.

Habitat:—Cultivated fields, flowerbeds, uncultivated land, urban vegetable gardens, rubbles, roadsides, backfills, river banks.

Elevation:—0–800 m a.s.l.

Chromosome number:—2n = 32 (Carretero 1984 from Spain, Dmitrieva 1986 from Belarus, Hindáková 1978 and Hindáková & Schwarzova 1987 from Slovakia, Queirós 1989 from Portugal, Krahulcová 1990 from formely Czechoslovakia, Song & al. 2002, Sheidai & Mohammadzdeh 2008).

Alien status:—Neophyte species native to North America, it can be considered invasive in Italy, causing threats in cultivated field by loss of crop efficiency (economical impact), and decreasing the floristic richness in urban ecosystems in which *A. blitoides* forms mono- or paucispecific communities (ecological impact) (see Iamonico 2009e).

Occurrence in Italy:—All Italian regions, excluding TAA: invasive in LOM, LAZ, and CAL; naturalized in FVG, PIE, EMR, MAR, ABR, CAM (Del Guacchio 2010), MOL, PUG (Iamonico 2009h, Iamonico & Rignanese 2013), SIC, and SAR (Pontecorvo 2007, Bacchetta *et al.* 2009, Ardenghi *et al.* 2011); casual alien in VEN (see also Masin & Scortegagna 2012), VDA, LIG, TOS (Iamonico & Forbicioni 2011), UMB, and BAS.

FIGURE 15. *Amaranthus blitoides*: **A)** individual (Puglia, Foggia province, Manfredonia town, uncultivated land), **B)** synflorescence, **C)** detail of flowers (Emilia-Romagna, Modena province, Castelnuovo Rangone town, river bed). [photos by L. Rignanese (**A**), and P. Ferrari (**B–C**)].

Taxonomic annotations:—On the basis of the leaf shape, var. *reverchonii* Uline & Bray was described differing from the autonym in having the leaf blade oblong-lanceolate with ratio length/width > 2 and the apex

acute (var. *blitoides* has the leaves obovate-spathulate with ratio length/width = 2 and the apex rounded). This morph might be a mere ecophene (Costea *et al.* 2001b), but further investigations (molecular study or cultivation test) are needed to verify its taxonomical value. Other variable features are: habitus, number of branches and leaves, ornamentation of adaxial leaf blade (sometime with a central whitish spot), colour of stem and fruit (sometimes reddish).

Specimina Visa Selecta:—ITALY. **Abruzzo**: margini delle vie litoranee e arene litoranee, Roseto degli Abruzzi, November 1950, *Zodda s.n.* (RO!); arene consolidate marittime, Roseto presso l'abitato lungo la spiaggia, 21 October 1955, *Zodda s.n.* (FI!); Pescara, lungo la rotabile litoranea a Nord della città, 4 October 1955, *Anzalone s.n.* (RO!); Torino di Sangro, margine superiore della lecceta, 31 September 2009, *Conti & Manzi 40941* (APP!). **Calabria**: Cosenza, Casino rago-Cassano Jonio, 400 m a.s.l., 26 September 1993, *Capparelli & Bernardo 1055* (CLU!); Cosenza, Crosia, fiumara Trionto, 9 November 1993, *Gangale & Bernardo s.n.* (CLU!); Crotone, Marchesato, ca. 4 km NE of Le Castella, Corso Soverito, 40−50 m a.s.l., 16 June 1997, *Vitek 1216/04* (CLU!); Locri, September 1999, *Bernardo 7440* (CLU!); Cosenza, Montalto Uffugo, 17 July 2007, *Maiorca & Puntillo 16201* (CLU!); Tropea, staz. Ferroviaria, 29 August 2007, *Iamonico s.n.* (HFLA!). **Campania**: Napoli, area dell'Italsider, 26 November 2008, *Del Guacchio, Panizza & Capasso s.n.* (*Herb. Del Guacchio*!). **Emilia-Romagna**: Piacenza, Ponte dell'Olio, torrente nure a Zaffignano, 100−200 m a.s.l., 1991, *Romani s.n.* (MSPC!); Piacena, Sarmato, torrente Tidone ad Agazzino, 50−100 m a.s.l., 1991, *Romani s.n.* (MSPC!); Piacenza, San Giorgio, torrente Nure a S. Damiano, sponda destra, 100−200 m a.s.l., 1996, *Romani s.n.* (MSPC!); Piacenza, Coli, fra Ponte e Forno, presso Rio Secco, 400−500 m a.s.l., 1997, *Romani s.n.* (MSPC!); Piacenza, Gossolengo, Trebbia a valle di Gossolengo, 50−100 m a.s.l., 1999, *Romani s.n.* (MSPC!). **Lazio**: Ostia mare, in arenosis lungo la via, August 1949, *Anzalone s.n.* (RO!); Montalto di Castro, campi in prossimità del mare, in una strada, 25 August 1957, *Montelucci s.n.* (RO!); Roma, Belsito-Monte Mario, inizio scala che sale a via Lucilio, 31 August 1957, *Bazzichelli s.n.* (RO!); Fregene, sud-Fregene, margine stradale, 9 July 1956, *Bonaventura s.n.* (RO!); Roma, P.le Clodio- via Teulada e dintorni, 11 September 1956, *Anzalone s.n.* (RO!); Roma, quartiere Ostiense, October 1956, *Cacciato s.n.* (RO!); Tor Vaianica (Lazio), litorale, October 1957, *Anzalone s.n.* (RO!); Roma, Cinecittà su marciapiedi in costruzione, 26 July 1964, *Cacciato s.n.* (FI!); Guidonia, macerie sopra la Chiesa Centenaria, 3 October 1965, *Montelucci s.n.* (RO!); Ostia, sabbie, 20 July 1971, *Cacciato s.n.* (FI!); rive del Tevere in Roma, presso riva Pian Due Torri, 18 July 1977, *Anzalone s.n.* (RO!); Tenuta di Castelporziano, verso S. Quercio, June 1986, *Anzalone s.n.* (RO!); Roma, Parco Urbano di Aguzzano, macerie, 6 August 2007, *Iamonico s.n.* (HFLA!); Valmontone, incolti, 15 October 2008, *Iamonico s.n.* (HFLA!). **Liguria**: Genova porto presso la nuova dogana, August 1889, *coll. illeg. s.n.* (RO!); Bisagno entro Genova, 18 August 1958, *Lusina s.n.* (RO!); lungo la strada che da San Bragno (Savona) costeggiando le ferrovie, porta alla stazione ferroviaria di San Giuseppe, 13 August 1970, *Catanzaro s.n.* (RO!); alla foce del fiume Roja, Ventimiglia, 1 September 1970, *Catanzaro s.n.* (RO!). **Marche**: dintorni di Fossombrone (valle del Metauro) presso la S.S. Flaminia a S. Lazzaro, luoghi erbosi incolti e submaceriosi, suolo calcareo-argilloso, 4 Septemebr 1964, *Brilli-Cattarini 2543* (PESA!); dintorni di Pedaso nell'alveo dell'Aso presso la foce, luoghi erbosi e maceriosi, suolo prevalentemente argilloso-sabbioso o ghiaioso argilloso-calcareo, 2 Septemebr 1966, *Brilli-Cattarini et Gubellini 2542* (PESA!). **Lombardia**: Milano, ex Scalo Sempione, October 1939, *Ceroni s.n.* (PAV!); Crema, staz. FS, m.piede, 19 September 1995, *Giordana s.n.* (*Herb. Giordana*!); Lodi, loc. Riolo, terra di riporto (svincolo), 21 September 2001, *Giordana s.n.* (*Herb. Giordana*!). **Piemonte**: Cambio (Alessandria), alluvioni presso il Po, 25 September 1964, *Anzalone s.n.* (RO!); Denice (Alessandria), fra l'abitato, 8 July 1966, *Anzalone s.n.* (RO!); lungo la strada statale Savona-Alessandria, prima di arrivare al centro urbano di Aqui, 18 August 1970, *Catanzaro s.n.* (RO!); al centro urbano di Aqui (Alessandria), 20 August 1970, *Catanzaro s.n.* (RO!); Trino (Vercelli), in una discarica nei pressi del po, 16 August 1977, *Anzalone s.n.* (RO!); Alessandria, Tortona, pressi del casello autostradale, 18 August 2000, *Argenti 0539/1* (*Herb. Argenti*!). **Puglia**: Mass. Lilla, San Ligorio (Lecce), 28 June 1990, *Annese s.n.* (LEC!); Scorrano (Lecce), bordo strada, 18 November 1990, *Pasca s.n.* (LEC!); Maglie, muro a secco, 21 November 1990, *Nucita s.n.* (LEC!); Mad. Dell'Artica (Castiglione), incolto arido, 21 July 1996, *Da Siena s.n.* (LEC!); Zone Borone (Rauccio-Idume, Lecce), oliveto, 25 October 1996, *Minonne s.n.* (LEC!); Alimini Grande, W-Otranto, pineta, 11 July 1999, *Caforio s.n.* (LEC!); Fontanelle (vicino Strittu), Otranto, bordo strada, 22 October 1999, *Caforio s.n.* (LEC!); Le Cesine (Lecce), 25 October 2007, *Sciandrello & Tomaselli 311564* (CAT!); Brindisi, Torre Guaceto, Orti, 1 m a.s.l., 4 July 2008, *Iamonico s.n.* (HFLA!). **Sardegna**: Palude di Sa Masa, Gonnesa (Cagliari), fanghi rossi, 3 m a.s.l., 5 October 2004, *Bacchetta, Angius, Casti et Mattana s.n.* (CAG!); *ibidem* (CAG!); Olbia, Cabu Abbas, incolti, scarpate, 60 m, 9 October 2013, *Calvia s.n.* (*Herb. Calvia*!); Berchidda, Rio S'isteramadu, 200−220 m a.s.l., 1 September 2005,

Calvia s.n. (*Herb. Calvia*!); Berchidda, Rio S'isteramadu, 200−220 m a.s.l., 22 October 2005, *Calvia s.n.* (*Herb. Calvia*!); Berchidda, Rio S'isteramadu, 200−220 m a.s.l., 22 December 2009, *Calvia s.n.* (*Herb. Calvia*!); Sassari, largo Monache Cappuccine, incolti, 13 January 2011, *Calvia s.n.* (HFLA!); Olbia-Tempio, Calangianus, Badu Mela, 450−500 m a.s.l., 3 September 2011, *Calvia s.n.* (*Herb. Calvia*!); Olbia, Cabu Abbas, incolti, scarpate, 60 m, 9 October 2013, *Calvia s.n.* (*Herb. Calvia*!); Oristano, Cabras, loc. Monti Prama, cigli stradali, 20 m, 6 October 2014, *Calvia s.n.* (*Herb. Calvia*!). **Sicilia**: Piana degli Albanesi, 19 September 2002, *Raimondo & Spadaro 72735* (PAL!); Piano Stella (Gela), 30 October 2004, *Sciandrello 006900* (CAT!); Marettimo, presso il paese, 27 October 2004, *Scuderi & Pasta 020142* (CAT!). **Valle d'Aosta**: Aosta, stazione ferroviaria lungo un muro, 28 July 1977, *Abbà s.n.* (TO!); *ibidem* (RO!). **Veneto**: along the highway from Padova to Bologna, at rest station San Pelagio Oevst, 8 m a.s.l., *Till 111006* (WU!).

12. *Amaranthus acutilobus* Uline & Bray, Bot. Gaz. 19: 320. 1894, nom. nov. pro *Euxolus emarginatus* A.Braun & Bouché non *Amaranthus emarginatus* Salzm. ex Moq. 1849 (Fig. 16).

Type (lectotype designated by Iamonico 2015):—GERMANY. "*Berol. Bot. Gart. Aus Mexico ... hort. Berol*", 1851, *Braun s.n.* (MO-101665!).

Description:—Herbs 1–2 dm tall, monoecious, annual (therophyte). Stems prostrate to erect, glabrous, brown, branched. Leaves green, obovate [0.7−2.5(−3.0) × 0.5−1.5 cm], with entire margins, apex deeply bilobe (sinus depth ¼−⅓ times of the total leaf blade length), mucronate, base cuneate, glabrous, petioled (petiole 0.5–3.0 cm long). Synflorescences arranged in axillary glomerules, green. Floral bracts light green, lanceolate [3.0–5.5(–6.5) × 0.5−1.5(–1.7) mm] longer (about 2 times) than the perianth (greater tepal), acute, mucronate or awned, margin entire, glabrous. Staminate flowers with (3−)5 tepals, ovate to lanceolate, apex acute, mucronate; stamens 3(−5). Pistillate flowers with 4(−5) unequal tepals, lanceolate [the greater 1.5–3.0(–3.5) × 0.5–1.3 mm, the other tepals 0.7−1.3 mm long (about half the length of male tepals)], with acute and mucronate apex; stigmas 3. Fruit green to brown, ellipsoidal [(1.5–)2.0–2.5(–3.5) × 1.0–2.0 mm], as long as or slightly longer than the perianth, smooth, indehiscent. Seed lenticular (about 1.0 mm in diameter), black.

Iconography:—Aellen (1959: 471, Figure 224), Beck (1909: Tab. 301, figures 6−7, sub *Euxolus emarginatus*).

Phenology:—Not possible to verify in the field, since the species was not recently recorded in Italy.

Habitat:—Human-made habitats.

Elevation:—0–300 m a.s.l.

Chromosome number:—2n = 32 (Kerguélen 1993).

Alien status:—Neophyte species native to Central America (Mexico), it can be considered casual alien in Italy.

Occurrence in Italy:—Formerly recorded in CAM, and CAL (Iamonico 2010d).

Specimina Visa Selecta:—ITALY. **Campania**: Neap, August, *sine coll. 1419* (LY!). **Calabria**: Gioia in Calabria, April, *sine coll. 1283* (LY!).

13. *Amaranthus muricatus* (Gillies ex Moq.) Hieron.[1], Plantae Diaphoricae Florae Argentinae 4(1): 421. 1882. (Fig. 17).

Basionym: *Euxolus muricatus* Gillies ex Moq., Prodr. [A. P. de Candolle] 13(2): 276. 1849.
Type (lectotype designated by Iamonico 2015):—ARGENTINA. Mendoza, *Gillies s.n.* (K-000195064!, plant on the bottom).

Description:—Herbs 3–6 dm tall, monoecious, perennial (hemicryptophyte). Stems prostrate-ascending, ± glabrous, usually pale brown, branched. Leaves dark-green, linear to linear-lanceolate [2.0−7.0(−8.0) × 0.3−2.0(−2.2) cm], with entire margins, apex obtuse to acute (sometimes emarginate), base cuneate, glabrous,

1. Hicken (1910: 92) proposed the new combination *A. muricatus* (Moq.) Hicken, but it is an isonym of *A. muricatus* (Moq.) Gillies ex Hieron. (Hieronymous 1881: 421). Hence, the Hicken's name has no nomenclatural status (Art. 6.3 of the ICN).

FIGURE 16. *Amaranthus acutilobus*: exsiccatum from Naples city (Campania) preserved at LY.

FIGURE 17. *Amaranthus muricatus*: **A)** individual (Molise, Campobasso province, Termoli town, city wall), **B)** synflorescence, **C)** detail of flowers (Sardegna, Cagliari province, Elmas locality, uncultivated land) [photos by D. Iamonico (**A**), and V. Lazzeri (**B–C**)].

petioled (petiole 1.0–3.5 cm long). Synflorescences terminal, spike-like, green. Floral bracts, brownish, linear-lanceolate (0.9–1.1 × 0.2–0.4 mm) shorter (about ½ times) than the perianth, acute, margin entire, glabrous. Staminate flowers with 5 tepals, ovate to lanceolate; stamens 3. Pistillate flowers with 5 tepals, lanceolate or spathulate (1.9–2.1 × 0.5–1.4 mm), with acute and mucronate apex; stigmas 3. Fruit brown, subglobose [1.8–2.0(–2.3) × 1.9–2.1 mm] as long as or sligthly longer (up to ¼ longer) than the perianth, rugose, indehiscent. Seed lenticular (1.0–1.4 mm in diameter), black.

Phenology:—Flowering from August to September.

Habitat:—Roadsides, ruderal habitats, walls.

Elevation:—0–300 m a.s.l.

Chromosome number:—2n = 34 (Carretero 1984 from Spain).

Alien status:—Neophyte species native to South America, it can be considered invasive in Italy. Nevertheless, no evident impacts were observed.

Occurrence in Italy:**—**Invasive in SAR; naturalized in MOL (Iamonico 2010d, 2013b), CAL, and SIC.

Specimina Visa Selecta:—ITALY. **Molise**: Termoli, prato sotto il trattto SW del muraglione che cinge il borgo vecchio, 15 m a.s.l., 12 October 1994, *Signorini s.n.* (FI!); Termoli, centro storico, tratto SW del muraglione del borgo antico, 20 m a.s.l., 12 August 2012, *Iamonico s.n.* (HFLA!); *ibidem*, 2 August 2014, *Iamonico s.n.* (HFLA!). **Sardegna**: Carbonia-Uglesias, Isola di San Pietro, 31 May 1998, *Anzalone s185* (RO!); *ibidem 184* (RO!); Cagliari, Elmas, incolto nei pressi della laguna di Santa Gilla, 3 m a.s.l., October 2012, *Lazzeri s.n.* (CAG!). **Sicilia**: Palermo, 15 October 1967, *Sortino 93728* (PAL!); Trapani, all'incrocio della strada via Vallona-via Giuseppe Errante (nelle vicinanze della palazzina dell'Ispettorato Dipartimentale delle Foreste), 25 July 1976, *Catanzaro s.n.* (FI!); Palermo, Ponte Ammiraglio, 08 November 1979, *Di Martino 93729* (PAL!); Palermo, lungo le strade adiacenti all'Orto Botanico, October 1979, *Anzalone s.n.* (RO!); Palermo, Piazza Scaffa, 5 October 2009, *Domina 86989* (PAL!).

14. ***Amaranthus crispus*** (Lesp. & Thév.) A.Braun ex J.M.Coult. & S.Watson, Manual (Gray), ed. 6. 428. 1890 (Fig. 18).

Basionym: *Euxolus crispus* Lesp. & Thév., Bull. Soc. Bot. France 6: 656. 1859.

Type (lectotype designated by Iamonico 2015):—FRANCE. *Lavoire à laine de Bessan*, 12 October 1858, *Théveveau s.n.* (P-00572004!, plant on the left).

= *Amaranthus crispus* N.Terracc., Atti R. Accad. Sci. Fis. Mat., ser. 2 4(2): 7. 1890, *nom. illeg.* [Art. 53.1 of the ICN (McNeill *et al.* 2012)].

Type (lectotype designated by Iamonico 2015):—ITALY. Lazio: Frosinone, *ad vias in submontosis Campaniae fontanaliri*, September 1821, *N. Terracciano s.n.* (FI!).

Description:—Herbs 1–4 dm tall, monoecious, annual (therophyte). Stems prostrate-ascending or diffuse, glabrous to sparsely pubescent, usually brown, branched. Leaves dark-green, ovate (0.6−2.0 × 0.3−1.0 cm), with crispate margins, apex acute to obtuse, mucronate, base cuneate, glabrous, petioled (petiole 0.3–0.5 cm long). Synflorescences arranged in axillary glomerules, green. Floral bracts, greenish to brownish, ovate-lanceolate [1.2–1.7 × 0.4−1.0(–1.2) mm], shorter than the perianth, acute, margin entire, usually glabrous. Staminate flowers with 5 tepals, lanceolate; stamens 3. Pistillate flowers with 5 tepals, ovate-spathulate [(1.5–)1.9–2.1 × 0.5–1.0(−1.3) mm], with rounded to obtuse, and mucronate apex; stigmas 3. Fruit brownish, ellipsoidal [1.8–2.0(–2.5) × 0.8–1.5 mm], as long as or slightly longer (up to ¼ longer) than the perianth, usually rugose, indehiscent. Seed lenticular (0.7–1.0 mm in diameter), black to dark reddish-brown.

Iconography:—Aellen (1959: 471, figure 217), Kops *et al.* (1924: t. 2058).

Phenology:—Flowering from July to September.

Habitat:—Roadsides, cultivated fields.

Elevation:—0–300 m a.s.l.

Chromosome number:—2n = 34 (Hindáková & Schwarzova 1980 from Slovakia).

Alien status:—Neophyte species native to South America (Argentina), it can be considered invasive in Italy. Nevertheless, no evident impacts were observed.

Occurrence in Italy:—Invasive in SAR (Bacchetta *et al.* 2009); casual alien in LAZ (Iamonico 2008a), VEN, and PIE (Carrega & Silla 1995, Gallo 2012, Iamonico 2013c). Recently excluded from CAM (Conti *et al.* 2007).

Specimina Visa Selecta:—ITALY. **Lazio**: ad vias submontosis Campaniae fontanaliri, September 1821, *Terracciano s.n.* (FI!); Roma, Cinecittà, 6 September 1963, *Cacciato s.n.* (RO!); *ibidem* (RO!); Roma, marciapiede in via Valerio Corvo al Quadraro, 21 September 1968, *Cacciato s.n.* (FI!). **Piemonte**: Torino, marciapiedi in Corso Oporto, Grugliasco e Re Umberto e vie Guicciardini e Giusta, 1916, *H.F. s.n.* (BI!); Torino, fra il selciato del Corso Oporto tra il Corso Siccardi ed il Corso Grugliasco, 6 August 1916, *Ferrari s.n.* (PAD!); Torino, sui marciapiedi all'estremo ovest di Via Giusti, 15 June 1916, *Zola s.n.* (FI!); Torino, sui marciapiedi all'estremo ovest di Via Giusti, 16 June 1916, *Zola s.n.* (FI!); Torino, sui marciapiedi all'estremo ovest di Via Giusti, 21 June 1916, *Zola s.n.* (FI!); Torino, in Corso Oporto, 22 June 1916, *Zola s.n.* (FI!); Torino, fra il selciato di corso Oporto e via Guicciardini, 18 August 1916, *Ferrari s.n.* (FI!); Torino, inter saxaet secus margines viarum in Corso Oporto, Grugliasco et Re Umberto, et in Via Guicciardini et in Via Giusta, 27 August 1916, *Ferrari s.n.* (FI!); *ibidem* (CAT!); Torino, fra i sassi lungo i marciapiedi di corso Oporto- Grugliasco e via Giucciardini e Giusti, 27 August 1916, *Ferrari s.n.* (FI!); Pedemontium–Augusta Taurinorum (Torino) inter saxa at secus margines viarum di Corso Oporto et Re Umberto, et in Via Guicciardini et Via Giusta, 27 August 1916, *Ferrari s.n.* (RO!); Augusta

Taurinorum (Torino), inter saxa et secus margines viarum (marciapiedi) in Corso Oporto, Gauliasco et Re Umberto, et in via Guicciardini et in via Giusta, 27 August 1916, *Ferrari s.n.* (PAD!); *ibidem* (CAT!); *ibidem* (TO!); Torino, Corso Grugliasco, tra i ciottoli del selciato, 23 July 1922 (FI!); Raccolto nell'Orto Botanico di Torino, 6 October 1931, *Ugolini s.n.* (PAD!); Lombriasco (Torino) lung le strade dell'abitato, October 1940, *Don Rinaldi s.n.* (TO!); San Sebastiano Po, sul piazzale del centro abitato, 8 Septemebr 1969, *Abbà s.n.* (TO!). **Veneto**: Padova, Hort. Pat., 12 August 1904, *sine collectore s.n.* (PAD!); Padova, Hort. Pat., 4 August 1905, *sine collectore s.n.* (PAD!)

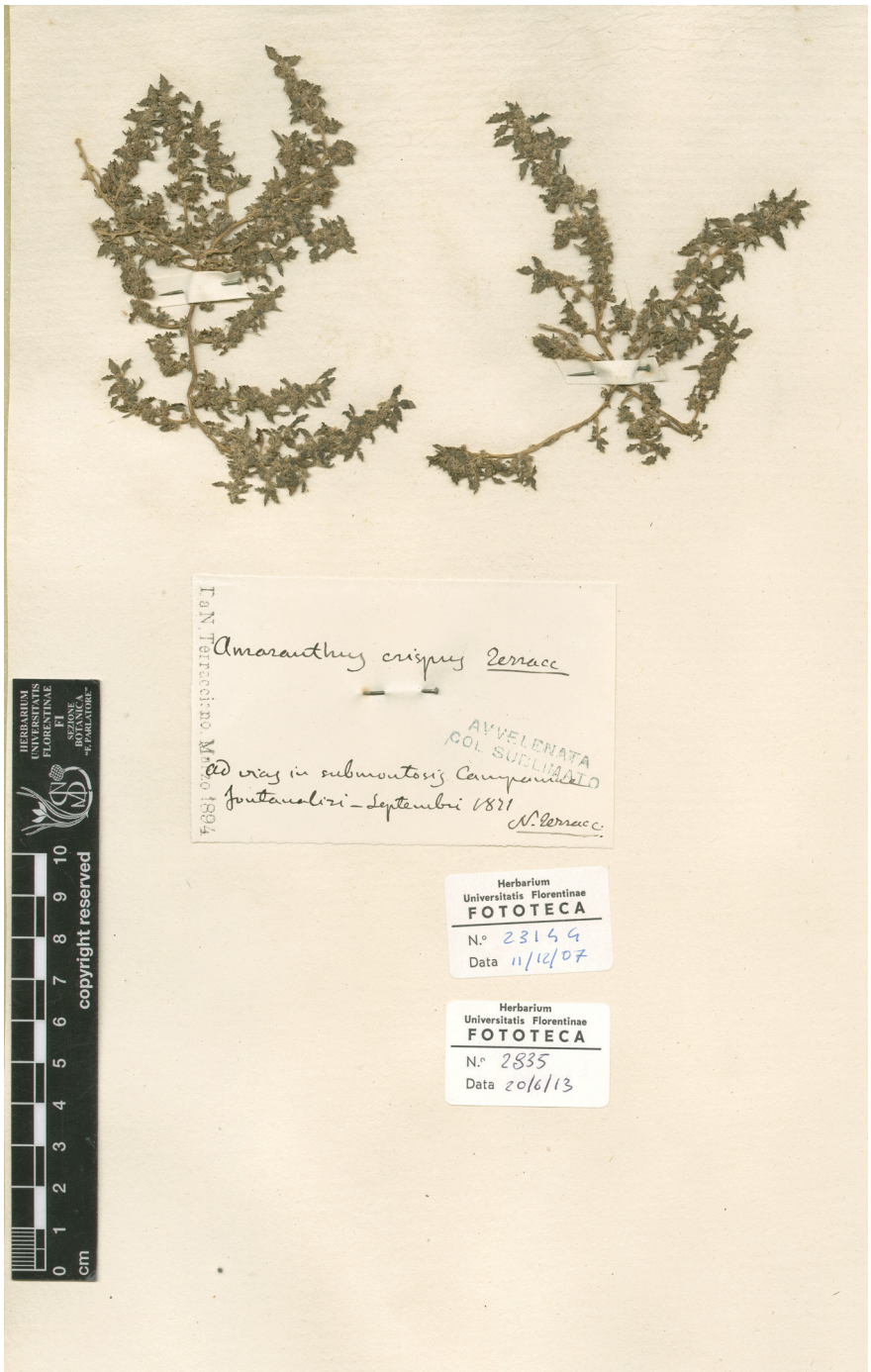

FIGURE 18. *Amaranthus crispus*: exsiccatum from Fontana Liri locality (Lazio) preserved at FI (original material of the illegitimate name *Amaranthus crispus* N.Terracc.).

15. *Amaranthus polygonoides* L., Pl. Jamaic. Pug. 27. 1759 (Fig. 19).

Type (lectotype designated by Hendrickson 1999: 797):—JAMAICA. [Icon] t. 92, f. 2 *"Blitum polygonoides viride seu ex viridi et albo variegatum polyanthos"* from Sloane (1707: 144).

FIGURE 19. *Amaranthus polygonoides*: exsiccatum from Barletta city (Puglia) preserved at G.

Description:—Herbs 1–3(–4) dm tall, monoecious, annual (therophyte). Stems prostrate or ascending, glabrous, green, few branched. Leaves green, ovate, rhomboidal [(0.6–)1.5−4.0 × (0.5−)0.6–2.0 cm], with entire or undulate margins, apex obtuse or emarginate, mucronate, base cuneate, glabrous, petioled (petiole 0.7–3.5 cm long). Synflorescences arranged in axillary glomerules, green or brown. Floral bracts, yellowish, linear-lanceolate to ovate (0.9–1.1 × 0.3−0.4 mm), shorter than the perianth, usually obtuse, margin entire, glabrous. Staminate flowers with (4−)5 tepals, ovate to lanceolate; stamens 2−3. Pistillate flowers with 5 tepals, linear-spathulate [1.9–2.7(–3.0) × 0.6–0.7 mm], with obtuse, and mucronate apex, clearly 3-veined, connate in proximal ⅓ and patent above; stigmas 3. Fruit brown-yellowish, ellipsoidal (2.0–2.5 × 0.8–1.0 mm), as long as the perianth, rugose in the distal part, indehiscent. Seed lenticular (0.8–1.0 mm in diameter), red-brown to black.

Iconography:—Iamonico (2010a: 208, figure 1).

Phenology:—Flowering from July to October.

Habitat:—Uncultivated lands, roadsides.

Elevation:—0–300 m a.s.l.

Chromosome number:—2n = 34 (Song *et al.* 2002).

Alien status:**—**Neophyte species native to South America (Argentina), it can be considered casual alien in Italy.

Occurrence in Italy:—TAA, LOM, MAR, ABR, CAM (Iamonico 2009d, 2010a), and PUG (Iamonico 2010a). Recently excluded from LAZ (Iamonico 2008a), and MOL (Iamonico 2009d). Formerly cultivated in VEN (Botanical Garden of Padova), and TOS (Botanical Gardens of Florence and Pisa) (Iamonico 2009d).

Taxonomic annotations:—The epithet "*polygonoides*" was used in several nomenclatural combinations at subspecies or varietal rank, but always referring to *A. emarginatus* (see Costea *et al.* 2001b, sub *A. blitum* subsp. *emarginatus*).

Specimina Visa Selecta:—ITALY**. Abruzzo**: Giulia, *s.d.* (ante 1831), *Tenore s.n.* (NAP!). **Campania**: Golfo di Napoli, *s.d.* (ante 1817), *Gussone s.n.* (NAP!). **Marche**: Porto d'Ascoli, July 1839, *Sanguinetti s.n.* (RO!); Senigallia, sui binari della stazione ferroviaria, 30 June 1946, *Bettini s.n.* (FI!); *ibidem* (FI!); *ibidem* (FI!); da semi di piante di Senigallia sul mio terrazzo in vaso, 22 July 1949, *Bettini s.n.* (FI!); Ascoli, *s.d.*, *sine coll. s.n.* (RO!). **Lombardia**: nelle sabbie e negli incolti nel mantovano, March 1877, *Barbieri s.n.* (FI!); Nasce nell'Orto botanico di Mantova spontaneo, *s.d.* (ante 1817)*, sine coll. s.n.* (PAD!). **Puglia**: Barletta, 1860, *Bruni s.n.* (G!). **Toscana**: Giardino dei Semplici, 1820, *sine coll. s.n.* (FI!); *Hort. Bot. Bonon*, 1829, *Bubani s.n.* (FI!); *H Pisano*, 1839, *sine coll. s.n.* (FI!); H. Bot. Mus. Flor., 27 June 1857, *sine coll. s.n.* (FI!). **Veneto**: Padova, Orto Botanico di Padova, coltivato, August 1896, *Adr. Fiori s.n.* (FI!).

III. *Amaranthus* subgenus *Amaranthus*

Note:—According to Mosyakin & Robertson (1996) the subgenus *Amaranthus* can be divided into three sections: sect. *Amaranthus*, nothosect. *Dubia* Mosyakin & Robertson, and sect. *Centrusa* Griseb. Concerning the sect. *Amaranthus*, at least two subsections can be recognized (subsect. *Amaranthus* and subsect. *Hybrida* Mosyakin & Robertson). Two sections (sect. *Amaranthus*, and sect. *Centrusa*), and 9 species occur in Italy: all taxa are included in sect. *Amaranthus* excepting for *A. spinosus* that belongs to the sect. *Centrusa*. The infrageneric classification of this group remains unsolved at present.

16. *Amaranthus caudatus* L., Sp. Pl. 2: 990. 1753 (Fig. 20).

Type (lectotype designated by Towsend 1974: 10):—UNKNOWN ORIGIN. *Habitat in Perù, Persia, Zeylonia, Herb. Linn. No. 1117.26* (LINN!).

Description:—Herbs 8–15 dm tall, monoecious, annual (therophyte). Stems erect, glabrous (often pubescent in the distal part), green to ± reddish, branched. Leaves green or red, ovate to lanceolate, rhomboidal [(5.0–)6.0–10.0(–15.0) × (2.0–)3.0–6.0(–10.0) cm], with entire margins, apex acute, mucronate, base cuneate, often pubescent, petioled [petiole 1.0–12.0(–15.0) cm long]. Synflorescences terminal, spike-like, up to 60−70 cm long, usually red to purple (rarely green or whitish), and pendulous. Floral bracts greenish to reddish, ovate to

FIGURE 20. *Amaranthus caudatus*: exsiccatum from Camerino town (Marche) preserved at RO.

lanceolate-linear (3.0–4.0 × 0.8−1.5 mm) longer than the perianth, acute, awned, margin entire, glabrous. Staminate flowers with 5 tepals, ovate; stamens 5. Pistillate flowers with 5 tepals, lanceolate-spathulate [(1.0–)1.5–2.0(–2.5) × 0.3–1.3 mm], with acute (in this case mucronate) or obtuse (sometimes emarginate) apex; stigmas 3. Fruit brownish, ellipsoidal to subglobose [(1.5–)2.0–2.5 × 1.4–1.7(–1.9) mm], as long as or longer than the perianth, smooth to rugose, dehiscent. Seed lenticular [(1.0–)1.2–1.3(–1.5) mm in diameter], dark-brown to brownish-black.

Iconography:—Beck (1909: Tab. 297, figures 1–2).

Phenology:—Flowering from July to October.

Habitat:—Human-made habitats near gardens.

Elevation:—0–300 m a.s.l.

Chromosome number:—2n = 32, 64 (Greizerstein & Poggio 1994, Song *et al.* 2002).

Alien status:—Neophyte species probably native to South America (Argentina, Equador, Peru, and Bolivia; Costea *et al.* 2001a), it can be considered casual alien in Italy. It is used as ornamental plant.

Occurrence in Italy:—Northern [not VDA; see also Masin & Scortegagna (2012) for VEN, and Iamonico & Antonietti (2015) for PIE] and Central Italy (not in MOL; Iamonico 2009i), while in Southern Italy only in PUG (Iamonico 2008c), and SIC; formerly recorded in LIG (Iamonico 2010d), and CAM.

Specimina Visa Selecta:—ITALY**. Abruzzo**: Dint. di l'Aquila, 6 September 1970, 700 m a.s.l., *Bravi s.n.* (AQUI!). **Emilia-Romagna**: inselvatichico nelle vicinanze di Bologna, July 1886, *Mattei s.n.* (FI!); inselvatichito qua e la, nei luoghi incolti, presso Bologna, September 1886, *Mattei 36122* (PAL!). **Marche**: dintorni di Grottazzolina nell'alveo del tenna presso S. Isidoro, depositi alluvionali ghioso-limosi, suolo prevalentemente argilloso-calcareo, humus nullo, 5 October 1984, *Brilli-Cattarini et Gubellini 2550* (PESA!). **Lombardia**: Como, via dei Mulini, November 1939, *Ceroni s.n.* (PAV!); Milano, Cuzziano, September 1965, *Stucchi 3275* (MSNM!); Cremona, fraz. Di Crema, località Sabbioni, ciglio Campereccia, 8 September 1995, *Giordana s.n.* (*Herb. Giordana*!); Olgiate Molgora, torrente Molgora, 27 October 2006, *sine coll. s.n.* (MSNM!); provincia di Varese, lungo una strada, 22 June 2007, *Galasso s.n.* (MSNM!); Spessa (Pavia), "lanca d'Enzo", ca. 500 m a nord dell'abitato di Portalbera, destra idrograÞ - ca del Þ ume Po, 54 m a.s.l., 28 September 2010, *Ardenghi s.n.* (*Herb. Ardenghi*!); *ibidem*, 30 September 2010 (*Herb. Ardenghi*!, MSNM!). **Liguria**: Varazze, orticolo?, 10 October 1929, *Gresino s.n.* (FI!). **Piemonte**: Trontano, Quarata, campo, 248 m a.s.l., 18 September 2002, *Antonietti s.n.* (*Herb. Antonietti*!, HFLA!). **Umbria**: Giardino del Colle del Cardinale, 1890, *Cicioni s.n.* (PERU!); Norcia (Perugia), basse pendici della Montagna di Civita, versante sud-est, poco prima di Norcia (provenienza Ancarano), 8 September 2006, 740 m a.s.l., *Ballelli s.n.* (CAME!, *Herb. Ballelli*!).

17. *Amaranthus spinosus* L., Sp. Pl. 2: 991. 1753 (Fig. 21).

Type (lectotype designated by Fawcett & Rendle 1914: 103):—ASIA. *Habitat in Indiis, Herb. Linn. No. 1117.27* (LINN!).

Description:—Herbs 3–8 dm tall, monoecious, annual (therophyte). Stems erect, ± glabrous (pubescent in the synflorescence part), ± reddish, branched. Leaves green, ovate to lanceolate, rhomboidal [(2.1–)2.5–7.0(–9.5) × (0.8–)1.0–3.0(–5.0) cm], with entire margins, apex obtuse, and mucronate, base cuneate, glabrous to pubescent, petioled (petiole 0.5–8.0 cm long), associated to 2 spine-like structures (modified bracts). Synflorescences terminal, panicle-like, the main florescence up to 25 cm long, usually green and axillary glomerules. Floral bracts yellowish, ovate to lanceolate (1.5–3.5 × 0.5−1.0 mm) as long as or shorter than the perianth, acute, awned, margin entire or undulate, glabrous. Staminate flowers with 5 tepals, ovate-lanceolate; stamens 5. Pistillate flowers with 5 tepals, lanceolate-spathulate (3.5–4.0 × 0.9–1.0 mm), with acute and mucronate apex; stigmas 3−4. Fruit brown or yellowish, ellipsoidal (2.0–2.1 × 1.4–1.5 mm) as long as or slightly shorter than the perianth, smooth below, rugose on top, dehiscent. Seed lenticular (0.7–0.9 mm in diameter), black.

Iconography:—Beck (1909: Tab. 297, figures 3–5).

Phenology:—Flowering from June to October.

Habitat:—River banks.

Elevation:—0–300 m a.s.l.

Chromosome number:—2n = 34, 68 (Paiva & Leitao 1989, Greizerstein & Poggio 1992, Greizerstein *et al.* 1997, Al-Turki *et al.* 2000, Song *et al.* 2002, Sheidai & Mohammadzdeh 2008).

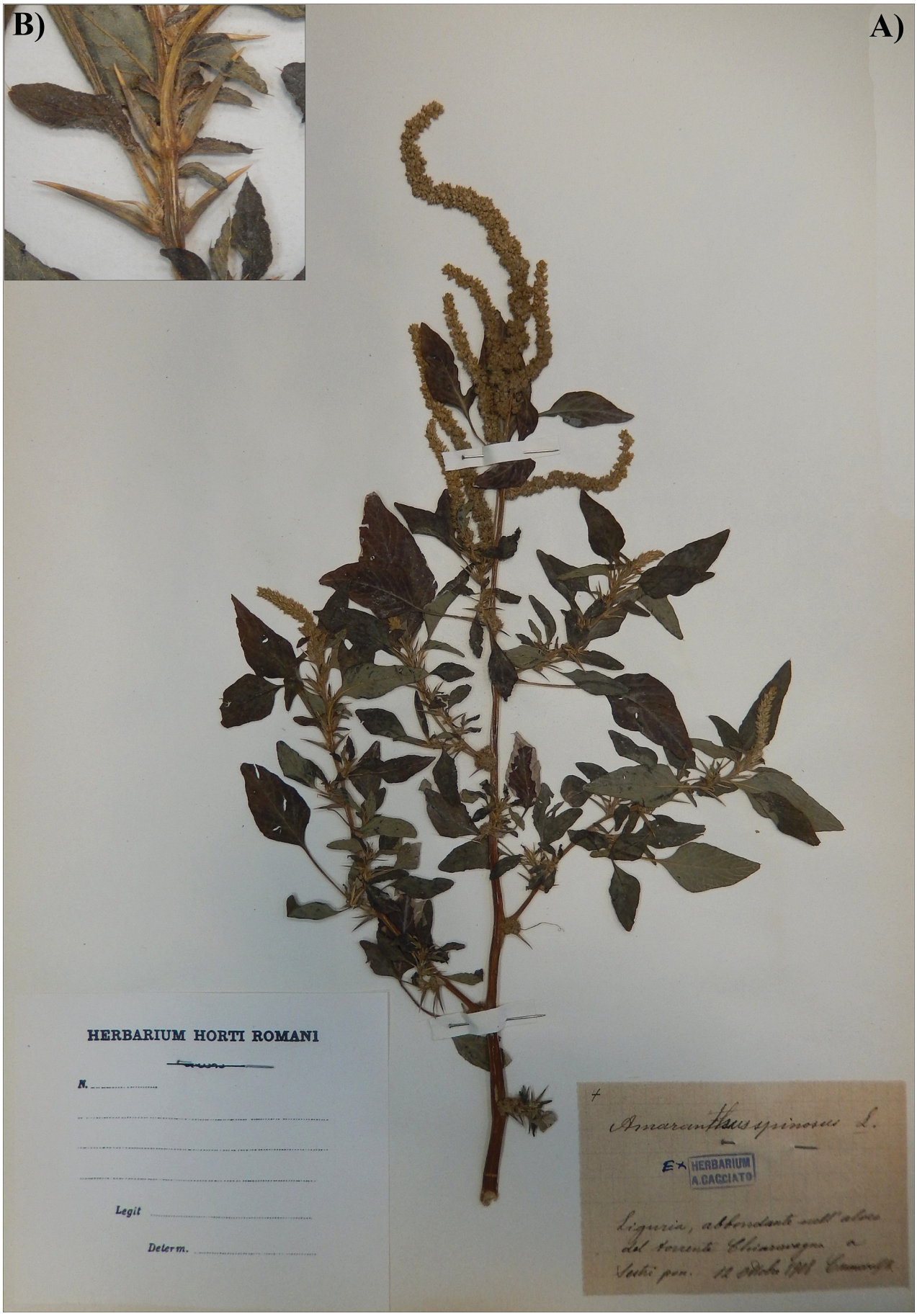

FIGURE 21. *Amaranthus spinosus*: **A)** exsiccatum from Vestri town (Liguria) preserved at RO, **B)** spine-like structures.

Alien status:—Neophyte species native to Neotropics, it can be considered casual alien in Italy.

Occurrence in Italy:—FVG, VEN, and EMR; formerly recorded in LIG. Recently excluded from LAZ (Fanelli *et al.* 2011, Iamonico 2012d).

Specimina Visa Selecta:—ITALY. **Liguria**: abbondante nell'alveo del torrente Chiaravagna a Vestri pon., 12 October 1908, *Canneva s.n.* (RO!); *ibidem* (RO!); Varazze in glaerosis torrentis, 3 m a.s.l., 15 August 1926, *Gresino s.n.* (FI!). **Veneto**: Vicenza, prope cotonificio Rossi et prope pontem supra Bacchiglione flumen, 25 November 1926, *Marchente 765* (CAT!); *ibidem 12099* (FI!).

18. ***Amaranthus retroflexus*** L., Sp. Pl. 2: 991. 1753 (Fig. 22).

Type (lectotype designated by Townsend 1974: 12):—NORTH AMERICA. *Herb. Linn. No. 1117.22* (LINN!).
− *Amaranthus strictus* Ten., Syll. Pl. Fl. Neapol.: 128. 1831, *nom. nud.* (see Iamonico 2015).

Description:—Herbs 1–17(–20) dm tall, monoecious, annual (therophyte). Stems usually erect, usually tomentose-pubescent, pale green to reddish, often branched. Leaves green, ovate to lanceolate, elliptic or rhomboidal [(2.0–)3.0–12.0(–15.0) × (1.0–)1.5–7.0(–8.0) cm], green (sometimes with white or red central spot and/or white curved band), with entire or undulate margins, apex acute or obtuse, often mucronate, base cuneate, glabrous to pubescent (sometimes pubescent only on the veins), petioled [petiole (1.0–)1.5–6.0(–7.5) cm long]. Synflorescences terminal, spike- or panicle-like, the main florescence up to 12 cm long (usually as long as or shorter than the paraclades), usually green. Floral bracts pale green to green-yellowish (rarely yellow), lanceolate (3.0–6.0 × 0.7−1.2 mm) usually longer than the perianth, acute, awned, with membranous border narrowing to apex, margin entire or undulate, glabrous. Staminate flowers with 5 tepals, ovate-lanceolate; stamens (3–)4–5. Pistillate flowers with 5 tepals, spathulate [2.0–3.0(–4.0) × 0.9–1.1 mm], with obtuse to emarginate and mucronate apex; stigmas 3. Fruit pale brown to dark-brown, ellipsoidal (1.5–2.5 × 1.0–1.3 mm) as long as or shorter than the perianth, smooth to slightly rugose, dehiscent. Seed lenticular [1.0–1.2(–1.4) mm in diameter], black to dark reddish-brown.

Iconography:—Clark & Fletcher (1906: t. 42), Beck (1909: Tab. 295, figures 1–7).

Phenology:—Flowering from June to October.

Habitat:—Flowerbeds, roadsides, uncultivated land, cultivated fields, railways, backfills, rubbles.

Elevation:—0–1500 m a.s.l.

Chromosome number:—2n = 32, 34, 102 (Heiser & Whitaker 1948, Weaver & McWilliams 1980, Ward 1984, Queirós 1989, Krasnikov & Lomonosova 1990 from Russia, Pandley 1999, Song *et al.* 2002, Lanta *et al.* 2003, Sheidai & Mohammadzdeh 2008).

Alien status:—Neophyte species native to North America, it can be considered invasive in Italy, causing threats in cultivated fields by loss of crop efficiency (economical impact) and decreasing the floristic richness in urban ecosystems (ecological impact) (see Iamonico 2010b).

Occurrence in Italy:—All Italian regions: naturalized in VEN (see also Masin & Scortegagna 2012), VDA (Iamonico & Bovio 2013), LIG, EMR, TOS, and SIC; invasive in the other regions.

Taxonomic annotations:—*Amaranthus retroflexus* is an extremely variable species, in all parts of the plant (habitus, plant size, colour and hairiness of the stem, leaf shape and size, leaf blade pattern, petiole length, synflorescence structure and colour, bract length and colour). As a consequence, several taxa (at subspecies, variety or form ranks) have been described (see e.g., IPNI, 2008). A morphometric population study and tests of cultivation are in progress (Iamonico in prep.) to verify the taxonomic identity of these forms. Meanwhile, the most common and observed infraspecific taxa follow:

- *Amaranthus retroflexus* f. *humistratus* Thell.: plant prostrate with twisted branches, main florescence often lacking;
- *Amaranthus retroflexus* f. *major* Moq.: plant erect, up to 17−20 dm; stem much branched, synflorescence terminal, panicle-like up to 50 cm, paraclades of third order often present;
- *Amaranthus retroflexus* f. *pusillus* Opiz: plant up to 3−10 cm, paraclades absent;
- *Amaranthus retroflexus* f. *rubricaulis* (Thell.) Probst ex Thell.: stem red, synflorescence red/reddish coloured;
- *Amaranthus retroflexus* var. *delilei* (Richter & Loret) Thell.: bracts not rigid and slightly spinescent, as long as or slightly longer than the perianth;

- *Amaranthus retroflexus* var. *delilei* f. *albimaculatus* Lusina: blade green with a curved white band ("U" or "V" shaped) in the middle;
- *Amaranthus retroflexus* var. *delilei* f. *bimaculatus* Lusina: blade green with a curved white band ("U" or "V" shaped) and circular red spot in the middle.

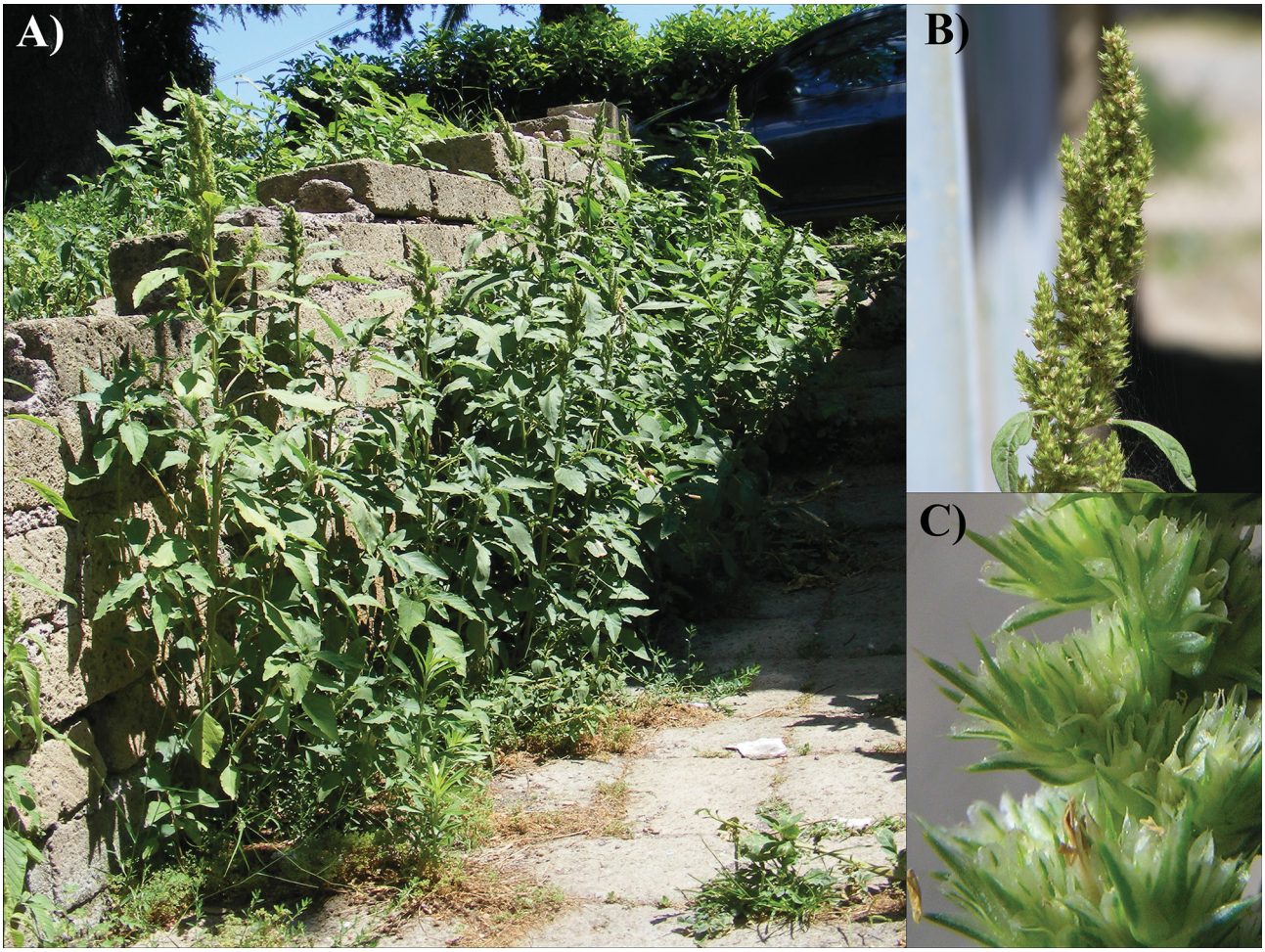

FIGURE 22. *Amaranthus retroflexus*: **A)** individual, **B)** synflorescence (Lazio, Rome province, Rome city, footway), **C)** detail of flowers (photos by D. Iamonico).

Specimina Visa Selecta:—ITALY. **Abruzzo**: al margine argilloso della via tra Roseto e Ovindoli, 1350 m a.s.l., 10 August 1950, *Lusina s.n.* (RO!); Lucoli (L'Aquila), September 1964, *Cipriani s.n.* (RO!); Giulianova, alveo del Tardino, 21 August 1965, *Zodda s.n.* (RO!); Colle Castrogno (Teramo), campi, 650 m a.s.l., 10 september 1965, *Zodda 5731* (APP!); Chiarino di Tossiccia, 400 m a.s.l., September 1965, *Plebani s.n.* (RO!); *ibidem 38343* (APP!); Val Vomano, alveo del Vomano, October 1965, *Zodda 5733* (APP!); loc. Collecchio presso Pescina (Pescina), pendii rupestri, 820 ca. m a.s.l., 14 October 1996, *Conti 48395* (APP!); Pineta d'Avalos (Pescara), Ambienti ruderali, 0−4 m a.s.l., 26 July 2003, *Conti 7724* (APP!); Palena-Lettopalena, Vallone di Izzo, riva fluviale, 618 m a.s.l., 31 August 2004, *Di Renzo 14669* (APP!); Valle del Tirino, sorgenti di Presciano, incolti, 400 m a.s.l., 17 October 2004, *Conti 12757* (APP!); Ofena, loc. "Le Vigne", Coltivi, 550 m a.s.l., 18 October 2004, *Conti 12754* (APP!); Recolle (Gagliano Aterno), cava, 650 m a.s.l., 25 September 2007, *Di Santo & Bartolucci 28345* (APP!); Incolti umidi nei pressi del Piomba (Atri), incolti umidi, 100 m a.s.l., 24 September 2009, *Bartolucci & Iocchi 38283* (APP!); Anversa degli Abruzzi, verso l'orto botanico, 25 September 2009, *Conti 41141* (APP!). **Basilicata**: Maratea, bordi di vie, 13 August 2008, *Iamonico s.n.* (HFLA!) **Calabria**: prov. Di Catanzaro, ca. 2 km NW of Gizzeria, 0−10 m a.s.l., 10 June 1997, *Vitek 1064* (CLU!); Marzi, sotto il Ponte Nuovo vicino alla confluenza del T.te Ara (Lara) col F.me Savuto, porv. Cosenza, greto, 10 October 1998, *Bartolotta 1053* (CLU!); Villapiana Scalo (prov. Cosenza) nei pressi della stazione ferroviaria, ambiente ruderale, 18 November 2006, *Bernardo 21334* (CLU!); Montalto Uffugo (Cosenza), ruderi e incolti, 163−293 m a.s.l., 16 June 2007 *Maiorca &*

Puntillo 81417 (CLU!). **Campania**: Salerno, San Mango Piemonte , Autostrada A3, stazione di servizio "Salerno Ovest", aiuola nel parcheggio adibito ai pullman, 150 m a.s.l., 16 August 2009, *Iamonico* (HFLA!); Avellino, Atripalda, in loc. Orto dei Preti, mergini stradali, 320 m a.s.l., 8 October 2009, *Del Guacchio s.n.* (*Herb. Del Guacchio*!). **Emilia-Romagna**: Ravenna (Candiano), August 1874, *Borgluz*, det. *Cacciato s.n.* (RO); Casalecchio, presso Bologna, leg. *Baldoni*, det. *Cacciato s.n.* (RO!); alveo del Reno presso il ponte della Venturina-Poiretta, August 1883, *Pizzini s.n.* (RO!). **Lazio**: Roma, Acquacetosa, 8 September 1955, *Piazzoli 4469* (MSNM!); Roma, Parioli, Tiro al Piccione, 12 September 1955, *Perroni 4470* (MSNM!). **Liguria**: Savona, Torre del Mare, lungo il litorale, 7 August 1970, *Catanzaro s.n.* (RO!); nei coltivati della contrada Valle-Calizzano (Savona), 2 August 1970, *Catanzaro s.n.* (RO!); Albenga, lungo le sponde del fiume Genta nel tratto che dal centro urbano porta alla foce, 18 August 1970, *Catanzaro s.n.* (RO!). **Lombardia**: Milano, Cuzziano, incolti, August 1931, *Stucchi 727* (MSNM!); lungo le sponde del fiume Po in vicinanza della confluenza tra il Po e il Ticino, 15 July 1969, *Catanzaro s.n.* (RO!); nel centro urbano di Genova, 24 August 1970, *Catanzaro s.n.* (RO!); Mantova, Suzzara, rive dei fossi, ruderi, golena del Po, prati concimati, 21 August 1992, *Truzzi 41* (*Herb. Truzzi*!); Mantova, Stoppiaro di Pogio Rusco, capezzagna, 22 June 2002, *Truzzi 41bis* (*Herb. Truzzi*!); Milano, Cesate, Parco delle Groane, campo incolto, 10 July 2003, *Gariboldi & Galasso 41087* (MSNM!); Brescia, via G. Togni, lungo la ferrovia, massicciata ferroviaria, ca. 141 m a.s.l., 19 October 2007, *Galasso 0427/3* (MSNM!). **Marche**: pr. Pioraco, September 1953, *Anzalone s.n.* (RO!); dintorni di Porto Recanati nell'alveo del Potenza presso il Ponte della S. S. Adriatica, ruderali, suolo sabbioso-argilloso, 06 October 1963, *Brilli-Cattarini 2616* (PESA!); dintorni di Porto Civitanova nell'alveo del Chienti presso la foce, luoghi maceriosi ed erbosi, suolo prevalentemente argilloso-calcareo, 14 September 1966, *Brilli-Cattarini et Sialm 2618* (PESA!); dintorni di Macerata nell'alveo del Chienti al ponte di Sforzacosta, depositi ghiaiosi subumidi, suolo prevalentemente calcareo, humus nullo, 5 September 1983, *Brilli-Cattarini et Gubellini 2615* (PESA!); dintorni di Montemonaco a S. Giorgio all'Isola, orti, suolo arenaceo, humus nullo, 5 September 1988, *Brilli-Cattarini et Gubellini 2621* (PESA!); dintorni di Pesaro presso Muraglia, campi incolti suolo prevalentemente argilloso-sabbioso, humus nullo, 20 August 1990, *Brilli-Cattarini 2606* (PESA!); Martinsicuro sull'argine destro del Tronto presso la foce, ruderati, suolo argilloso o argilloso-sabbioso, humus nullo, 20 September 1991, *Brilli-Cattarini, di Massimo et Gubellini 2601* (PESA!); Sentina (San Benedetto del Tronto), ambienti ruderali e incolti, 0−10 m a.s.l., 14 October 2008, *Conti 39474* (APP!); *ibidem 39475* (APP!); Sentina, fosso collettore presso l'ingresso N della Riserva (San Benedetto del Tronto), ambienti ruderali e incolti, 0−10 m a.s.l., 10 April 2009, *Conti & Bracchetti 39477* (APP!); Sentina (San Benedetto del Tronto), ambienti ruderali e incolti, 0−10 m a.s.l., 7 September 2009, *Conti 39470* (APP!); *ibidem 39471* (APP!); Provincia di Ancona, bordo via verso la spiaggia Mezzavalle, 12 August 2010, *Iamonico s.n.* (HFLA!); Castelfidardo, bordi di vie, 1 August 2010 *Iamonico s.n.* (HFLA!); Provincia di Ancona, bordo via verso la spiaggia Mezzavalle, 12 August 2010, *Iamonico* (HFLA!). **Piemonte**: dintorni di Torino in ruderi, October 1894, *Ferrari s.n.* (RO!). Domodossola, Mocogna, incolto verso mont, 335 m a.s.l, 28 July 2001, *Antonietti s.n.* (*Herb. Antonietti*!); Domodossola, Anzuno, incolto, 540 m a.s.l., 22 July 2002, *Antonietti s.n.* (*Herb. Antonietti*!); Domodossola, Rione Badulerio, via Girola, bordo asfalto/muro, 625 m a.s.l., 15 August 2006, *Antonietti s.n.* (*Herb. Antonietti*!); Domodossola, Anzuno, ex-fosso letame, 550 m a.s.l., 6 July 2007, *Antonietti s.n.* (*Herb. Antonietti*!); Domodossola, via del Toce, incolto-ruder, 270 m a.s.l., 26 Semptember 2011, *Antonietti s.n.* (*Herb. Antonietti*!); Baveno, riva lago con *Salix babyl.*, ciottol., 195 m a.s.l., 21 Sptemebr 2012, *Antonietti s.n.* (*Herb. Antonietti*!). **Puglia**: Is. Tremiti, October 1909, *Mucciarelli s.n.* (RO!). **Sardegna**: Berchidda, Tempio Pausania, Fundu di Monti, incolti aridi, cigli stradali, 550−600 m, 12 August 2009, *Calvia s.n.* (*Herb. Calvia*!); Olbia-Tempio, Calangianus, Badu Mela, incolti, strade, massicciate ferroviarie, 550−600 m, 3 September 2011, *Calvia s.n.* (*Herb. Calvia*!). **Sicilia**: Pantelleria, in vicinanza del mare, September 1959, *Catanzaro s.n.* (RO!); entro il recinto della stazione ferroviaria di Gallitello (Trapani), 21 Noveber 1969, *Catanzaro s.n.* (RO!). **Toscana**: Marina di Pisa, 22 July 1909, *Cicioni s.n.* (PERU!); Maremma, Monte Argentario, Along a dust road between wineyards, 50 m a.s.l., 12 september 2011, *Till 11058* (WU!). **Umbria**: Trasimeno a Torricella, July 1886, *Cicioni s.n.* (PERU!); Trasimeno al Ferretto, 23 September 1886, *Cicioni s.n.* (PERU!); Perugia, presso Cenerente, 1886, *Cicioni s.n.* (PERU!); dintorni di Perugia a Favarone, July 1903, *Cicioni s.n.* (PERU!); 46,5 km SSE Arezzo, St. Panicale, 7 km S Castiglione del Lago, 10 September 2001, *Walter 4335* (WU!). **Valle d'Aosta**: …bois aux environs des villes… Gignod La Tour plus rare que le chlorostachys, 1860, *Rostan s.n.* (FI!); Bard, 24 July 1860, *Carestias.n.* (TO!); Rovine Castello d'Ussel (Châtillon), 20 August 1885, *Belli s.n.* (TO); Aosta a Gressan, 30 August 1898, *Vaccari s.n.* (FI!); Aosta alla staz. ferrov., 15 September 1900, *Vaccari s.n.* (FI!); Entre Pontbozet et Champorcher,

900–1400 m a.s.l., 2 September 1903, *Vaccari s.n.* (FI!); Aosta alle Fourches, 650 m a.s.l., 24 August 1904, *Vaccari s.n.* (FI!); Aosta, 600 m a.s.l., 15 August 1909, *Vaccari s.n.* (FI!); Donnaz, August 1901, *Vaccari s.n.* (FI!); Bard, incolti e prati abbandonati e aridi tra la SS 26 e la Dora Baltea, a nord di Bard, 337 m a.s.l., 1 October 1990, *Bovio et Rosset s.n.* (*Herb. Bovio*!); Champdepraz, Val Chalamy, macerie a Covarey, 1270 m a.s.l., 15 October 1992, *Bovio et Giuntas.n.* (AO!); Aosta città, June 1993, *Boccafogli s.n.* (TO!); Perloz, verso Marine, 660 m a.s.l., 31 July 2005, *Cerutti s.n.* (*Herb. Cerutti*!); Gressan, 650 m a.s.l., *s.d.*, *sine coll. s.n.* (AO!). **Veneto**: Flora Veronensis, in cultis, August 1889, *Goiran s.n.* (RO!); Belluno, Perarolo, lungo la Cavallera, Valle del Piave, 600–700 m a.s.l., 21 August 1922, *Pampanini 9540/3* (PAD!); Belluno, Vodo, Valle del Boite, 825 m a.s.l., 18 August 1923, *Pampanini 9539/3* (PAD!); Belluno, Perarolo, S. Andrea, Valle del Piave, 650–750 m a.s.l., 30 July 1931, *Pampanini 9640/1* (PAD!); Belluno, Lozzo, Valle del Piave, 750–775 m a.s.l., 19 August 1936, *Pampanini 9540/2* (PAD!); luoghi ruderali pr. Padova, 24 August 1951, *Lusina 5928* (RO!); Belluno, Cavarzano, incolti, 12 August 1982, *Argenti 9839/1* (*Herb. Argenti*!); Belluno, Ponte S. Felice di Sedico, 22 September 1999, *Argenti 9938/2* (*Herb*. *Argenti*!); Belluno, Seghe di Villa di Sedico, 9 August 2009, *Argenti 9838/4* (*Herb. Argenti*!).

19–24. *Amaranthus hybridus* aggregate.

General description:—Herbs monoecious, annual (therophyte). Stems usually erect, glabrous to pubescent (especially in the synflorescence part), green to reddish, often branched. Leaves usually green, ovate to lanceolate, rhomboidal, petioled. Synflorescences terminal, spike- or panicle-like, the main florescence usually longer than the paraclades, green to purple-red. Floral bracts as long as or longer than the perianth (up to 4 times longer), acute, awned, with membranous borders narrowing to apex (terminal spiny tip clearly shorter than the half of the length of the bract) or abruptly interrupted at the half (terminal spiny tip about ½ longer than the bract). Staminate flowers with 3−5 tepals; stamens 3−5. Pistillate flowers with 5 tepals with acute apex, shorter than the stigmas; stigmas 3. Fruit subglobose to ellipsoidal, dehiscent or indehiscent. Seed lenticular, brown to black.

Taxa included (for Italy):—*Amaranthus hybridus* L., *A. cruentus* L., *A. hypochondriacus* L., *A. cacciatoi* (Aellen ex Cacciato) Iamonico, *A. powellii* S.Watson, and *A. bouchonii* Thell.

Taxonomic annotations:—Karyological and molecular studies (e.g., Greizerstein *et al.* 1997, Pandley 1999, Xu & Sun 2001, Rayburn *et al.* 2005, Wassom & Tranel 2005, Costea *et al.* 2006, Pratt *et al.* 2008) demonstrated that the taxa included in this aggregate are very closely related. Also morphological and biometrical data (e.g., Costea *et al.* 2001a, Iamonico 2012a) showed a high similarity. The criticism is also related to the nomenclatural disorders, caused by repeated misapplication of names.

The taxonomic concept of these taxa ranged between the recognition of separate taxa (e.g., Sauer 1967, Jonsell 2001) to the complete lumping of the cultivated forms with their putative wild progenitors (e.g., Greuter *et al.* 1984). The evolutionary origin of the grain amaranths is still unclear and two hypotheses can be suggested (see e.g., Sauer 1967):

1. Monophyletic hypothesis: the cultivated species, *A. caudatus* (some authors also included this taxon into the *Amaranthus hybridus* aggregate), *A. cruentus*, and *A. hypochondriacus*, originated from a single wild progenitor (*A. hybridus*) followed by introgressive hybridization with two distinct wild species in different regions. In particular, the first domesticated species was *A. cruentu*s, derived from *A. hybridus* (in Central America), followed by the domestication of *A. hypochondriacus* by repeated crossing of *A. cruentus* with *A. powellii* (in Mexico), and of *A. caudatus* by crossings with *A. quitensis* (in South America);
2. Polyphyletic hypothesis: each of the cultivated species was domesticated separately from different wild species. As a consequence, *A. hypochondriacus* was domesticated in Mexico from *A. powellii*, *A. cruentus* in Central America from *A. hybridus*, and *A. caudatus* in South America from *A. quitensis*.

A comprehensive molecular and phylogenetic study on this critical group (also including *A. bouchonii*, and *A. cacciatoi*) is lacking. It could definitively clarify the relationships within this aggregate. Since the present study aims at emphasizing the morphological differences between the taxa involved (that appear to be constant), I here prefer to recognize them as separate species.

1. Bracts with membranous borders abruptly interrupted at the half and apex clearly awned; tepals subequal (flower actinomorphic) with distinct median vein 2
- Bracts with membranous borders narrowing to apex; tepals subequal or clearly unequal (flowers actino- or zygomorphic)

with or without median vein 3
2. Bracts clearly longer (1.6−2.0 times) than the perianth; tepals with median vein usually dark-green ..... 19. *A. hybridus*
- Bracts as long as or slightly longer (up to 1.5 times) than the perianth; tepals with median vein usually yellow-brown ..... 20. *A. cruentus*
3. Tepals with a distinct median vein, yellow-brown to reddish; synflorescence panicle-like with main florescence (1.5−)2.0−2.5 cm wide, often moniliform, red or purple ..... 21. *A. hypochondriacus*
– Tepals without or with an inconspicuous (yellow or green) median vein; synflorescence spike- or panicle-like with main florescence 1.0(−2.0) cm wide, never moniliform, usually green 4
4. Tepals equal in size or nearly so (flower actinomorphic); synflorescence always lax and not erect, with many lateral branches; main florescence up to 9 cm long (rarely 12 cm); bract/tepal length ratio 1.2–2.3; fruit dehiscent ..... 22. *A. cacciatoi*
– Tepals unequal in size (flower zygomorphic); synflorescence both stiff and erect, unbranched or with very few widely spaced branches (in this case bract/tepal length ratio 2.3–3.7, and fruit dehiscent) and lax and not erect, with many lateral branches (in this case bract/tepal length ratio 1.2–2.3, and fruit indehiscent); main florescence up to 25 cm long 5
5. Inflorescence dense, stiff and erect, unbranched or with very few widely spaced branches; bract/tepal length ratio 2.3–3.7; fruit dehiscent ..... 23. *A. powellii*
– Inflorescence lax and not erect, with many lateral branches; bract/tepal length ratio 1.2–2.3; fruit indehiscent ..... 24. *A. bouchonii*

19. *Amaranthus hybridus* L., Sp. Pl. 2: 990. 1753 (Fig. 23).

Type (lectotype designated by Townsend 1974: 19):—U.S.A. *Habitat in Virginia, Herb. Linn. No. 1117.19* (LINN!).
= *Amaranthus chlorostachys* Willd., Hist. Amaranth.: 34. 1790.
Type (lectotype designated by Iamonico 2015):—UNSPECIFIED LOCALITY, *Hermes s.n.* (B-17521!).
= *Amaranthus patulus* Bertol., Comment. Itin. Neapol. 19. 1837.
Type (lectotype designated by Iamonico 2015):—ITALY. Campania: Napoli al Pasconcello, September 1834, *Bertoloni s.n.* (BOLO!).
= *Amaranthus hybridus* L. subsp. *hybridus* var. *erythrostachys* Moq., Prodr. [A.P. de Candolle] 13(2): 259. 1849.
Type (lectotype designated by Iamonico 2015):—FRANCE. "*Hort. Tol.*", 1844, *sine coll. s.n.* (G-147762/1!).

Description:—Herbs 6–20(–25) dm tall, monoecious, annual (therophyte). Stems erect, glabrous (pubescent in the upper part), green to reddish, often branched. Leaves usually green, ovate to ovate-lanceolate, rhomboidal [(2.0–)3.0–8.0(–13.0) × (1.0–)1.5–6.0(–6.0) cm], with usually entire margins, apex acute or obtuse, mucronate, base cuneate, usually glabrous, petioled [petiole (1.0–)1.5–4.0(–6.0) cm long]. Synflorescences terminal, panicle-like, the main florescence usually up to 15 cm long (longer than the paraclades), usually green. Floral bracts greenish or yellowish, lanceolate to lanceolate-linear [(2.5–4.5(–6.0) × 1.0−1.5 mm)], 1.6−2.0 times longer than the perianth, acute, awned, with membranous border abruptly interrupted at the half, margin entire, glabrous. Staminate flowers with 5 tepals, ovate-lanceolate; stamens (4–)5. Pistillate flowers with 5 tepals, ovate to lanceolate [(1.5–)2.0–2.5(–3.0) × 0.5–0.7 mm], with acute and sometimes mucronate apex, median vein usually dark-green; stigmas 3. Fruit usually brown, ellipsoidal [1.5–2.5(–3.5) × 1.0–1.2 mm], as long as or longer than the perianth, smooth to rugose, dehiscent. Seed lenticular (0.9–1.4 mm in diameter), black to dark reddish-brown.

Iconography:—Carretero (1990: 563, Lám. 170a−e, and 1990: 560, figure 2), Ardenghi & Parolo (2010: 71, figure 6b, e).

Phenology:—Flowering from June to October.

Habitat:—Uncultivated land, roadsides, cultivated fields.

Elevation:—0–1000 m a.s.l.

Chromosome number:—2n = 32, 34 (Tandon & Tawakley 1970, Weaver & McWilliams 1980, Ward 1984, Xu 1987, Pal & Pandley 1989, Queirós 1989 from Portugal, Greizerstein *et al.* 1997, Song *et al.* 2002, Sheidai & Mohammadzdeh 2008).

Alien status:—Neophyte species native to tropical areas of North and Central America, it can be considered invasive in Italy, causing threats in cultivated fields by loss of crop efficiency (economical impact) and decreasing the floristic richness in urban ecosystems (ecological impact) (see Iamonico 2010b).

Occurrence in Italy:—All Italian regions: invasive in LOM, LAZ, CAL, and SAR; casual alien in LIG, TOS, and PUG; naturalized in the other regions [see Masin & Scortegagna (2012) for central and southern VEN]. Doubtfully recorded in VDA (Iamonico & Bovio 2013).

FIGURE 23. *Amaranthus hybridus*: **A)** individual (Lazio, Rome province, Rome city, footway), **B)** synflorescence, **C)** detail of flowers (Arbuzzo, L'Aquila province, Barisciano town, uncultivated land) (photos by D. Iamonico).

Taxonomic annotations:—*Amaranthus hybridus* is a very variable species from a morphological point of view, especially in flower characters. On the basis of the tepal shape, apex and position, Costea *et al.* (2001a) recognized two subspecies and proposed the combination *A. hybridus* subsp. *quitensis* (Kunth) Costea & Carretero (basionym *Amaranthus quitensis* Kunth) to identify the forms characterized by obovate to spathulate tepals with obtuse to truncate apex, sometimes outcurved and as long as or longer than the fruit. The present study allowed to confirm the occurrence in Italy of *A. hybridus sensu stricto* only. However, a detailed nomenclatural and taxonomic study on *A. quitensis* is lacking, and its identity remains unclear. The usage of the name *A. quitensis* changed over time, showing a large disagreement among the authors. Bolòs & Vigo (1974: 89) proposed the combination *A. retroflexus* subsp. *quitensis* (Kunth) Bolòs & Vigo, while other authors linked *A. quitensis* to *A. hybridus* (e.g., Covas 1941, sub *A. hybridus* var. *quitensis*). Some authors (e.g., Aellen 1959) accept *A. quitensis* as a separate species. Finally, *A. quitensis* has also been treated as a synonym of *A. hybridus* (e.g., Coons 1978, Jørgensen & Ulloa Ulloa 1994, Pinto & Velásquez 2010, Egea *et al.* 2011), or of *A. caudatus* (e.g., Kerguélen 1999). In my opinion, the taxon *quitensis* is related to *A. retroflexus*, on the basis of tepal shape and length. A study is in progress (D. Iamonico in preparation).

Specimina Visa Selecta:—ITALY. **Abruzzo**: Tione degli Abruzzi, lungo il F. Aterno, margine di strada, 501 m a.s.l., 25 September 2007, *Bartolucci & Di Santo 28203* (APP!); Molina Aterno, alveo ghiaioso, 450 m a.s.l., 25 Septmber 2007, *Bartolucci & Di Santo 28382* (APP!); Goriano Sicoli, Loc. Macchione, Incolti, 785 m a.s.l., 25 September 2007, *Bartolucci & Di Santo 29956* (APP!); Lecceta di Torino di Sangro, 4 June 2009, *Conti 46248* (APP!); Anversa degli Abruzzi, Gole del Sagittario tra Cavuto e la frana, riva sinistra del fiume, incolti e pascoli, 08 July 2009, *Conti 42022* (APP!). **Basilicata**: Maratea, loc. Cersuta, bordi di vie, 16 August 2008, *Iamonico s.n.* (HFLA!) **Calabria**: Cittadella del Capo (Cosenza), torrento San Tommaso, 80 m a.s.l., 10 September 1991, *Crusco*

1063 (CLU!); Laino Castello, centro storico, Prov. Cosenza, vegetazione ruderale, 26 August 1998, *Fortunato 1060* (CLU!). **Campania**: Napoli al Pasconcello, September 1834, *Bertoloni s.n.* (BOLO!); Avellino, Atripalda, Santissimo Quarter, 31 July 2007, *Del Guacchio s.n.* (*Herb. Del Guacchio*!); Salerno, Altavilla Silentina, loc. Quercioni, October 2008, *Del Guacchio s.n.* (*Herb. Del Guacchio*!); Caserta, San Gregorio Matese, lago Matese, 27 September 2009, *Del Guacchio & Petolicchio s.n.* (*Herb. Del Guacchio*!). **Emilia-Romagna**: Piacenza, San Giorgio Piacentino, Val Nure/Val Riglio, fra Viustino e Godi, campo di pomodori, 125 m a.s.l., 2008, *Romani s.n.* (MSPC!); Viustino, strada per Godi, campo di pomodoro, 130 m a.s.l., 22 Septemebr 2009, *Romani s.n.* (HFLA!); Castel San Giovanni (Piacenza), Strada del Merlino, presso Fornaci, margine di campo di mais, 2 September 2010, 88 m a.s.l., *Ardenghi 001122* (*Herb. Ardenghi*!). **Friuli-Venezia Giulia**: Forojulia, Sagrado, 26 September 1903, *Evers s.n.* (GZU!). **Lazio**: Roma, Parco Urbano di Aguzzano, terreno da riporto, 31 August 2008, *Iamonico s.n.* (HFLA!); Oasi di Castel di Guido, terreno macerioso, 19 September 2008, *Iamonico s.n.* (HFLA!); Valmontone, incolti presso la stazione ferroviaria, 15 October 2008, *Iamonico s.n.* (HFLA!); Aprilia, Campoleone, loc. Casalazzara, margini di vie, 9 September 2009, *Iamonico s.n.* (HFLA!); Aprilia, campo di peperoni, 9 September 2009, *Iamonico s.n.* (HFLA!). **Lombardia**: Como, Erba, September 1957, *Stucchi 729* (MSNM!); Milano, via F. Restelli, numeri disparri, margine stradale, 120 m a.sl., 30 September 1992, *Galasso 3157* (MSNM!); bassa Brianza-Vimencate, destra idrografica torrente Molgora all'altezza dell'asilodi via Galbussera, boscaglia di Robinie, 191 m a.s.l., 11 Juy 1994, *Rovelli 35027* (MSNM!); Varese, Casazuigno, valle del torrente Boesio, sterrato tra Casa Favorita e il torrente Boesio, campo di mais, 280 m a.s.l., 28 August 2007, *Galasso 39377* (MSNM!). **Marche**: Dintorni di S. Angelo in Vado presso la cascata del Sasso, campi coltivati e incolti, suolo prevalentemente argilloso, humus nullo, 25 September 1980, *Brilli-Cattarini et Gubellini 2599* (PESA!); **Piemonte**: Verbania, Fondotoce, a valle post. Pr. Sede Ente Parco, terreno umido sass.-pantanoso, 194 m a.s.l., 30 October 2003, *Antonietti s.n.* (*Herb. Antonietti*!); Vogogna, viale delle Chiese, 215 m a.s.l., incolti ruderali, terreno sassoso, 21 August 2006, *Antonietti s.n.* (*Herb. Antonietti*!). **Toscana**: Pisa, scarichi lungo le strade, Septeber 1862, *Caruel s.n.* (RO!); Massa-Carrara, 18 September 1968, *Cipriani s.n.* (RO!). **Trentino-Alto Adige**: Muralta, August 1890, *Evers s.n.* (GZU!); Weg von Levico nach Calceranica, 24 August 1896, *Evers s.n.* (WU!); Sant'Ilario (Rovereto), incolti aridi, 200 m a.s.l., 23 August 1987, *Festi 0032/3* (ROV!); a Festa di Brentonico (M. Baldo), ambiente ruderale, 880 m a.s.l., 6 September 1989, *Prosser 0131/4* (ROV!). **Veneto**: Vicenza, 19 September 1868, *Pedicino s.n.* (RO!); Padova, 1951, *Lusina s.n.* (RO!); Belluno, Santa Giustina Bellunese, 2 October 1979, *Lasen 9938/1* (*Herb. Lasen*!); Belluno, Cavarzano, incolti, 12 August 1982, *Argenti 9839/1* (*Herb. Argenti*!); Belluno, Anta di Belluno, colture di mais, 18 August 1990, *Argenti 9839/3* (*Herb. Argenti*!); Belluno, Cavarzano, incolti, 27 September 2003, *Argenti 9839/1* (*Herb. Argenti*!); provincia di Verona, Garda, Capo S. Vigilio, lungolago ca. 400 m a.s.l. a E di Villa Guarieti, ghiaia umida, 67 m a.s.l, 18 October 2006, *Prosser 0430/1* (ROV!); Belluno, Cusighe di Belluno, 12 October 2008, *Argenti* 9839/1 (*Herb. Argenti*!); Belluno, Romasciens di Puos d'Alpago, incolti, 430 m a.s.l., 7 October 2009, *Argenti 9840/3* (*Herb. Argenti*!).

20. ***Amaranthus cruentus*** L., Syst. Nat., ed. 10. 2: 1269. 1759 (Fig. 24).

Type (lectotype designated by Townsend 1974: 12):—CHINA. *Habitat in China, Herb. Linn. No. 1117.25* (LINN!).

= *Amaranthus flavus* L., Syst. Nat., ed. 10. 2: 1269. 1759.

Type (lectotype designated by Iamonico 2014a: 147):—UNKNOWN ORIGIN. *Herb. Linn. No. 1117.23* (LINN!).

= *Amaranthus paniculatus* L., Sp. Pl., ed. 2. 2: 1406. 1763.

Type (lectotype designated by El Hadidi & El Hadidy 1981: 37):—AMERICA. *Habitat in America, Herb. Linn. No. 1117.20* (LINN!).

= *Amaranthus sanguineus* L., Sp. Pl., ed. 2. 2: 1407. 1763.

Type (lectotype designated by Iamonico 2014a: 148):—UNKNOWN ORIGIN. *Herb. Linn. No. 1117.21* (LINN!).

Description:—Herbs 5–14 dm tall, monoecious, annual (therophyte). Stems erect, ± glabrous (slightly pubescent in the upper part), red or green, often distally branched. Leaves usually green, ovate to ovate-lanceolate, rhomboidal [(3.0–)5.0–12.0(–14.0) × (1.5–)3.0–6.0(–7.0) cm], with entire margins, apex acute or obtuse (sometimes slightly emarginate), mucronate, base cuneate, glabrous or slightly pubescent, petioled (petiole 1.5–10.0 cm long) (sometimes sessile). Synflorescences terminal, panicle-like, the main florescence up to 15 cm long (longer than the paraclades), red or green. Floral bracts green or greenish, lanceolate (2.0–3.5 × 0.8−1.3 mm), 1.0−1.5 longer than the perianth, acute, awned, with membranous border abruptly interrupted at the half, margin entire, glabrous. Staminate flowers with 5 tepals, ovate-lanceolate; stamens (4–)5. Pistillate flowers with 5 tepals,

ovate-lanceolate [(1.5–)2.0–2.5(–3.0) × 0.6–1.5 mm], with acute and sometimes mucronate apex, median vein usually yellow-brown; stigmas 3. Fruit brown, ellipsoidal (2.0–2.5 × 1.4–1.6 mm), longer than the perianth, smooth to slightly rugose, dehiscent. Seed lenticular (1.2–1.6 mm in diameter), dark-brown to reddish-brown.

Iconography:—Carretero (1990: 560, figure 1), Willdenow (1790: Tab. II fig. 4, sub *A. paniculatus*), Beck (1909: Tab. 296, figures 3–4, sub *Euxolus patulus*).

Phenology:—Flowering from June to September.

Habitat:—Uncultivated land, roadsides.

Elevation:—0–800 m a.s.l.

Chromosome number:—2n = 32, 34 [Grant 1959, Tandon & Tawakley 1970, Pal & Khoshoo 1973, Greizerstein & Poggio 1994, Queirós 1989 (sub *A. paniculatus*) from Portugal, Pandley 1999, Song *et al.* 2002, Sheidai & Mohammadzdeh 2008].

Alien status:—Neophyte species native to Central America, it can be considered invasive in Italy. Nevertheless, no evident impacts were observed.

FIGURE 24. *Amaranthus cruentus* (Lazio, Frosinone province, Monticelli locality, uncultivated land): **A)** individual, **B)** particular of synflorescence, **C)** detail of flowers (photos by F. Neild).

Occurrence in Italy:—All Italian regions: invasive in TOS (Arrigoni & Viegi 2011), MAR, and SAR; casual in FVG, TAA, LIG, PUG, and CAL; naturalized in the other regions (see Iamonico 2012d for LAZ and Masin &

Scortegagna (2012) for central and southern VEN). Recently excluded from VDA (Iamonico & Bovio 2013). Concerning LOM, Conti *et al.* (2007) excluded *A. cruentus* from the regional flora, since the species occurs mainly as a cultivated species, only rarely escaping from cultivation. Anyway, some specimens, preserved at RO, and MSNM (see Specimina Visa Selecta) refer to plants clearly collected outside of cultivation, highlighting the occurrence of this species in LOM, at least as a casual.

Taxonomic annotations:—*Amaranthus cruentus* is less variable than the related *A. hybridus*. The morphological variation includes: leaf surface (totally green, green with a white band arch-shaped, or green with a central red spot), synflorescence pattern (the paraclades can be erect to patent), and colour of the stem and synflorescence (from green to red or dark-red). Some cultivars (*A. cruentus* is also used as ornamental plant in Italy), especially those with dark-red synflorescences, can be confused with some forms of *A. hypochondriacus*, but the two species differ each other by the characters of the bracts (see the diagnostic key).

Specimina Visa Selecta:—ITALY. **Abruzzo**: Anversa degli Abruzzi campi e radure sotto la foresteria, 8 July 2009, *Conti 41982* (APP!); Anversa degli Abruzzi, verso l'orto botanico, 25 September 2009, *Conti 41143* (APP!) **Campania**: Salerno, *s.d.*, *Pedicino s.n.* (RO!). **Emilia-Romagna**: Modena, luoghi incolti in Villa Casinalbo, 1 September 1884, *Mori s.n.* (RO!). **Friuli-Venezia Giulia**: campi presso il l. di Pietrarossa, 18 August 1953, *Sallis s.n.* (RO!); provincia di Udine, Aquileia, ca 2 km a sud, bordo di canale di irrigazione, 2 m a.s.l., 30 October 2001, *Vettori s.n.* (ROV!). **Lazio**: Aiola nel giardino dell'Ist. Bot. Roma, 25 August 1949, *Lusina s.n.* (RO!); Roma, Lago di Bracciano, 29 September 1958, *Mariano 4471* (MSNM!); Roma, Prenestino, October 1993, *Cacciato s.n.* (RO!); Riserva Naturale Nomentum, incolti all'entrata del bosco Trentani, 8 July 2008, *Iamonico s.n.* (HFLA!). **Liguria**: Savona, sul terrapieno del orto dopo le funivie, 15 August 1970, *Catanzaro s.n.* (RO!). **Lombardia**: Bastioni di Pavia, August 1876, *sine coll. s.n.* (RO!); Milano, Cuzziano, August 1931, *Stucchi 730* (MSNM!); Milano, Quarto Cagnino, August 1948, *Piazzoli 4468* (MSNM!); Brescia, via G. Togni, lungo la ferrovia, massicciata ferroviaria, ca. 141 m a.s.l., 19 October 2007, *Galasso 0427/3* (MSNM!). **Marche**: dintorni di Pesaro presso S. Veneranda, luoghi maceriosi ed erbosi incolti, suolo argilloso-sabbioso, 16 October 1964, *Brilli-Cattarini 2557* (PESA!); dintorni di Senigalia nel litorale tra Senigalia e Borgo Cesano, luoghi maceriosi. Suolo prevalentemente argilloso-sabbioso, 13 October 1975, *Brilli-Cattarini 2579* (PESA!); dintorni di Petritoli nell'alveo dell'Aso tra S. Angelo e il Ponte di Carassai, depositi ghiaiosi alluvionali, suolo prevalentemente argilloso-calcareo, humus nullo, 23 September 1983, *Brilli-Cattarini et Gubellini 2567* (PESA!); dintorni di Grottazzolina nell'alveo del Tenna presso S. Isidoro, depositi alluvionali ghiaiosi, suolo prevalentemente argilloso-calcareo, humus nullo, 5 October 1984, *Brilli-Cattarini et Gubellini 2575* (PESA!). **Sicilia**: Pantelleria, July 1959, *Catanzaro s.n.* (RO!). **Toscana**: nel Forte dei Marmi presso Seravezza, September 1888, *Rossetti s.n.* (PERU!); incolti a Roncato di Decimo, presso Borgo a Mozzano (Lucca), 75 m a.s.l. circa, 24 October 1981, *Marchetti 3950* (ROV!). **Trentino-Alto Adige**: provincia di Trento, Val di Ledro, Prè nell'abitato, in un orto, 490 m a.s.l., 24 September 2000, *Prosser 00130/2* (ROV!); Rovereto, via del Garda, incolto erboso, ca. 173 m a.s.l., 12 October 2004, *Vettori 0132/1* (ROV!). **Umbria**: luoghi erbosi del Monte Subasio, *Bellini s.n.* (RO!). **Veneto**: dintorni di Verona, 2 september 1890, *Cicioni s.n.* (PERU!); Belluno, Dorgnan di Cesiomaggiore, 1 August 1980, *Lasen 9937/2* (*Herb. Lasen*!); Belluno, Cavarzano, incolti, 12 August 1980, *Argenti 9839/1* (*Herb. Argenti*!); Belluno, Feltre, stazione FFSS, 6 September 1985, *Lasen 9937/3* (*Herb. Lasen*!); Belluno, Lambioi di Belluno, incolti, 8 September 2000, *Argenti 9839/3* (*Herb. Argenti*!); Provincia di Verona, Gium subito a nord dell'abitato, bordo strada, 95 m a.s.l., 20 October 2001, *Prosser 0430/4* (ROV!); provncia di Verona, Brentino Belluno, Valle dell'Adige, a NE di Belluno Veronese, tra l'area di servizio autostradale «Adige Est» e il F. Adige, margine di coltivo, 120 m a.s.l., 18 September 2006, *Bertolli & Prosser 0331/2* (ROV!); Belluno, Mel, ruderale, 26 July 2009, *Argenti 9938/1* (*Herb. Argenti*!).

21. *Amaranthus hypochondriacus* L., Sp. Pl. 2: 991. 1753 (Fig. 25).

Type (lectotype designated by Townsend 1985: 25):—U.S.A.. *Habitat in Virginia, Herb. Linn. No. 1117.24* (LINN!).

Description:—Herbs 4–16 dm tall, monoecious, annual (therophyte). Stems erect, ± glabrous (pubescent in the synflorescence part), red or green, branched. Leaves green to reddish, ovate to ovate-lanceolate, rhomboidal [(4.0–)5.0–12.0 × (2.0–)3.0–6.0(–7.0) cm], with entire margins, apex acute or obtuse (sometimes emarginate), mucronate, base cuneate, usually glabrous, petioled (petiole 3.0–9.0 cm long) (sometimes sessile). Synflorescences terminal, or panicle-like, the main florescence up to 25 cm long (longer than the paraclades), and (1.5−)2.0−2.5 cm

wide, often moniliform, red or purple (sometimes yellowish). Floral bracts greenish to yellowish, lanceolate to lanceolate-linear [(3.0–5.0(–6.5) × 0.5−1.0 mm], 1.5−2.0 longer than the perianth, acute, awned, with membranous border narrowing to the apex, margin entire, glabrous. Staminate flowers with 3–5 tepals, ovate-lanceolate; stamens 3–5. Pistillate flowers with 5 unequal tepals, lanceolate [(1.3–)3.0–3.5 × 0.6–1.0 mm], with usually acute and awned apex, often red to amaranth coloured, with a distinct median vein yellow-brown to brown-reddish; stigmas 3. Fruit brown, ellipsoidal [1.5–2.0(–3.0) × 1.1–1.5 mm], as long as the perianth, smooth to sligthly rugose, dehiscent. Seed lenticular (1.0–1.4 mm in diameter), ivory, pinkish-white, reddish-brown, or black.

Iconography:—Carretero (1990: 560, figure 3), Bojian *et al.* [2003: 418, figure 337(4)].

Phenology:—Flowering from June to October.

Habitat:—Human-made habitats near gardens, but also in cultivated fields and roadsides.

Elevation:—0–500 m a.s.l.

Chromosome number:—2n = 32, 34 (Tandon & Tawakley 1970, Pal *et al.* 1982, Palomino & Rubi 1991, Greizerstein & Poggio 1994, Song *et al.* 2002).

Alien status:—Neophyte species native to North America, it can be considered casual alien in Italy, albeit Arrigoni & Viegi (2011) and Bacchetta *et al.* (2009) reported *A. hypochondriacus* as naturalized in Tuscany and Sardinia, respectively. Field surveys showed that this species is an unsuccessful escape from cultivation. It is used as ornamental plant, especially the cultivars with moniliform synflorescences (e.g., the cv. 'Elephant Head').

Occurrence in Italy:—FVG, VEN (Iamonico 2012b), LOM, PIE (Iamonico & Antonietti 2015), TOS, LAZ, ABR (Iamonico 2009i), MOL (Stinca & Motti 2013), CAM, BAS, SIC, and SAR; formerly recorded in EMR, MAR, and UMB (Iamonico 2010d).

Taxonomic annotations:—The phenotypic variability of *A. hypochondriacus* mainly refers to the synflorescence structure that can be moniliform, with the main florescence about 2−2.5 cm wide, and clearly longer than the paraclades, or not moniliform, with the main florescence about 1.0−1.5 cm wide, as long as or slightly longer than the paraclades. Some cultivars (*A. hypochondriacus* is also an ornamental plant in Italy), can be confused with some forms of *A. cruentus*, but the two species differ from each other by bract characters (see the diagnostic key).

Specimina Visa Selecta:—ITALY**. Abruzzo**: Vallelonga, al Molino in mezzo ai granturchi, 6 September 1904, *Grande s.n.* (FI!); Scerne di Pineto, ad margines viarum, September 1948, *Zodda s.n.* (FI!). **Campania**: Avellino, margini della strada statale per Benevento, November 2011, *Del Guacchio & Scopece s.n.* (*Herb. Del Guacchio*!). **Lazio**: Roma, luoghi erbosi e incolti lungo le vie Labico e Formia, October 1946, *Cacciato s.n.* (RO!); presso Subiaco (Santa Scolastica), 25 September 1961, *Anzalone 171* (RO!); Roma, via Prenestina, in erboso, 19 November 1961, *Cacciato s.n.* (RO!); Roma, macerie da demolizione in via di Portonaccio, 18 Septemebr 1963, *Cacciato s.n.* (RO!); Roma, in un prato a Centocelle nei pressi dell'aeroporto, 12 September 1967, *Cacciato s.n.* (RO!); Roma, marciapiede in fondo muratura in Via Giulio Agricola 28 July 1968, *Cacciato s.n.* (RO!); Roma, 20 September 1968, *Cacciato s.n.* (RO!); Roma, lungo Via di Portonaccio, 20 September 1968, *Cacciato s.n.* (RO!); Roma, 4 August 1969, *Cacciato s.n.* (RO!); Circeo (Mondello), 18 Augut 1969, *Cacciato s.n.* (RO!); Roma, presso Ponte Milvio, October 1976, *Anzalone s.n.* (RO!); Roma, a via di Pietralata, Septemebr 1978, *Anzalone s.n.* (RO!); Circeo (Molella), 18 August 1969, *Cacciato s.n.* (RO!); Roma, 4 August 1969, *Cacciato s.n.* (RO!). **Lombardia**: Milano, Cuzziano, August 1969, *Stucchi 3277* (MSNM!); Sondrio, Dubino, lungo il sentiero che attraversa il Pian di Spagna per condurre alla riva del lago verso la Mera, margine di sentiero, *s.d.*, *Savisenti 22234* (MSNM!). **Marche**: Senigallia, alle Bettolelle, sfuggito alla coltura, 19 September 1939, *coll. illeg. 432* (FI!). **Molise**: Isernia, Montaquila, bordo strada ed incolto, 332 m, a.s.l., 8 October 2012, *Stinca s.n.* (FI!). **Piemonte**: Torino, piede del rivestimento sostegno scarpata nod... di via S. Donato, 8 Septemebr 1935, *Zola s.n.* (FI!); Domodossola, Villadossola Boschetto, tra cunetta e marciapiede, 440 m a.s.l., 21 September 2001, *Antonietti s.n.* (*Herb. Antonietti*!);; Pieve Vergonte, Mégolo di mezzo, terreno sassoso, 215 m s.l.m., *Antonietti s.n.* (*Herb. Antonietti*!); Beura-Cardezza, Carale, alveo (F. Toce) sabb., 225 m a.s.l., 21 September 2009, *Antonietti s.n.* (*Herb. Antonietti*!). **Toscana**: Pisa, Calci, lungo la strada per Montemaggiore, 19 October 1969, *Catanzaro s.n.* (RO!). **Umbria**: dintorni di Terni, sui margini dei corsi d'acqua, 26 August 1893, *sine coll. s.n.* (FI!). **Veneto**: in un campo a Cozzuolo (Vittorio), 148 m a.s.l., 24 August 1895, *Pampanini s.n.* (FI!); campi nella Valdonega, September/ October 1901, *Goiran s.n.* (FI!); Prov. Di Verona, Peschiera, lungo i fossi inselvatichito, 68 m a.s.l., 31 August 1919, *Adr. Fiori s.n.* (FI!); provincia di Verona, Malcesine, tra Navene e loc. Martora, al lato N del nuovo porto, su terreno da riporto, 67 m a.s.l., 9 November 2006, *Bertolli & Prosser 0231/1* (ROV!).

FIGURE 25. *Amaranthus hypochondriacus*: exsiccatum from Subiaco town (Lazio) preserved at RO.

FIGURE 26. *Amaranthus cacciatoi*: holotype of the name *A. bouchonii* var. *cacciatoi* [Lazio, Rome city (G)].

22. *Amaranthus cacciatoi*[1] (Aellen ex Cacciato) Iamonico, Willdenowia 43(2): 239−240. 2013 (Fig. 26).

Basionym: *Amaranthus bouchonii* Thell. var. *cacciatoi* Aellen ex Cacciato, Ann. Bot. (Rome) 28: 618. 1966. ≡ *Amaranthus powellii* S.Watson subsp. *cacciatoi* (Aellen ex Cacciato) Iamonico, Nordic J. Bot. 30(1): 13. 2012.
Type:—ITALY. Lazio: Roma, in ruderatis, communis in ipse Urbe, 12 August 1965, *Cacciato 98* (holotype: G!).
− *Amaranthus bouchonii* Thell. p.p. *sensu* Conti *et al.* (2005: 51).
− *Amaranthus powellii* S.Watson p.p. *sensu* Celesti-Grapow *et al.* (2009a: 428).

Description:—Herbs 0.7–1.6 dm tall, monoecious, annual (therophyte). Stems erect, sparsely pubescent (sometimes moderately pubescent in the synflorescence part), green, branched. Leaves green, ovate, rhomboidal (3.0–13.0 × 1.5–6.0 cm), with entire margins, apex obtuse, mucronate, base cuneate, glabrous or sparsely pubescent, petioled (petiole 3.0–10.0 cm long) (sometimes sessile). Synflorescences terminal, panicle-like, lax and not erect, with many lateral branches, the main florescence (1.7–)2−9(–12) cm long (as long as or longer than the paraclades), green. Floral bracts greenish to yellowish, lanceolate (2.2–3.9 × 0.4−1.0 mm), 1.8−2.2 times longer than the perianth, acute, awned, with membranous margin narrowing to the apex, margin entire, glabrous. Staminate flowers with 5 tepals, ovate-lanceolate; stamens 3–5. Pistillate flowers with 5 equal (sometimes slightly unequal) tepals (actinomorphic or slightly zygomorphic flowers), lanceolate to linear [(1.0–)1.2–1.4(–1.8) × 0.3–0.8 mm], with parallel lateral margins, acute and sometimes mucronate apex; stigmas 3; ratio bract/tepal length 1.8–2.3. Fruit brown or pale brown, subglobose (1.0–1.4 × 0.6–1.1 mm), 1.1−1.6 times longer than the perianth, smooth, dehiscent. Seed lenticular (0.4–1.1 mm in diameter), black or brown.

Iconography:—Pignatti (1982: 178, figure 389, sub *A. bouchonii*).

Phenology:—Flowering from May to September.

Habitat:—Roadsides, uncultivated land.

Elevation:—20–60 m a.s.l.

Chromosome number:—Unknown.

Chorology:—Iamonico (2012a) indicated this taxon of uncertain origin, probably endemic to Italy. Examination of American specimens of *A. powellii* reveals the absence of plants with the characteristics of *A. cacciatoi*. The literature analyzed does not indicate any plants of *A. powellii* that can be referred to the *A. cacciatoi*. Likely, this species was introduced from the New World and has evolved independently in Europe, or it is of hybrid origin, or the product of introgression with other species. *A. cacciatoi* is related to *A. powellii*, and *A. bouchonii*. However, although subspecies rank was proposed for the three taxa (Costea & al. 2001a, Iamonico 2012a), they have a different origin: *A. powellii* is native to the Americas, *A. bouchonii* is known from Western Europe, and *A. cacciatoi* is known only from Central Italy. Today, *A. powellii* and *A. bouchonii* are spread by man all over the world and the original distribution ranges are blurred. In order to reflect their different evolutionary histories, Iamonico (2013d) proposed the species rank for the *A. cacciatoi*, and recognized the other taxa at species rank as part of the treatment of *Amaranthus* within the Euro+Med PlantBase project.

Occurrence in Italy:—Only in LAZ, in South-Southeast metropolitan area of Rome (Cacciato 1966, Iamonico (2012a).

Specimina Visa Selecta:—ITALY. **Lazio**: Roma, Piazza R. Malatesta, 4 November 1960, *Cacciato* (RO!); Roma, Centocelle, 29 August 1961, *Cacciato s.n.* (RO!); Roma, 20 August 1962, *Cacciato s.n.* (RO!). Roma, Cinecittà , 14 June 1963, *Cacciato s.n.* (RO!); Roma, ruderati a Torpignattara, 14 August 1964, *Cacciato 5026.5* (FI!); Roma, in ruderatis, communis in ipse Urbe, 12 August 1965, *Cacciato 98* (G!); Roma, prati a Cinecittà, 10 August 1965, *Cacciato s.n.* (RO!); Roma, 28 August 1966, *Cacciato 13* (G!); Roma, 4 October 1968, *Cacciato s.n.* (RO!); Roma, lungo via di Portonaccio, 20 August 1968, *Cacciato s.n.* (RO!); Roma, 14 July 1970, *Cacciato s.n.* (RO!); Roma, via Appia Nuova, all'altezza di via delle Capannelle, incolti al margine della strada, 15 September 2008, *Iamonico s.n.* (HFLA!); Roma, Parco degli Acquedotti (zona Tuscolana-Cinecittà), incolti, 17 August 2009, *Iamonico s.n.* (HFLA!).

23. *Amaranthus powellii*[2] S.Watson, Proc. Amer. Acad. Arts 10: 347. 1875 (Fig. 27).

Type (lectotype designated by Iamonico 2015):—U.S.A. Arizona: "*from Powell's Arizona seeds*", 1874, *Powell s.n.* (US-00106256!).

1. A. Cacciato (1907–1986), Italian botanist, studied the genus *Amaranthus* in the 1960's and 1970's.
2. J.W. Powell (1834–1902), American botanist.

Description:—Herbs (4–)8–10(–12) dm tall, monoecious, annual (therophyte). Stems erect, glabrous (slightly pubescent in the synflorescence region), green (sometimes red), simple or branched. Leaves green, ovate to lanceolate, more or less rhomboidal [(3.0–)4.0–15.0(–18.0) × (1.0–)1.5–6.0 cm], with entire margins, apex obtuse (sometimes slightly emarginate), usually mucronate, base cuneate, usually glabrous, petioled [petiole (2.5–)3.0–14.0(–16.0) cm long] (sometimes sessile). Synflorescences terminal, panicle-like, stiff and erect, unbranched or with very few widely spaced branches, the main florescence 5−25 cm long, usually green. Floral bracts green to yellowish (sometimes reddish), lanceolate to linear-lanceolate (2.7–5.1 × 0.4−0.9 mm), longer than the perianth (2.3–3.7 times), acute, awned, with membranous border narrowing to apex, margin entire, glabrous. Staminate flowers with 3−5 tepals, ovate-lanceolate; stamens 3–5. Pistillate flowers with 5 unequal tepals (zygomorphic flowers), lanceolate (0.8–2.1 × 0.4–0.6 mm), with acute and mucronate apex, without or with inconspicuous median vein; stigmas 3; ratio bract/tepal length 2.3–3.7. Fruit brown, ellipsoidal or subglobose [(0.8–)1.0–1.6 × 0.7–1.4(–1.5) mm], as long as or longer than the perianth, slightly rugose, dehiscent. Seed lenticular [(0.6–)0.8–1.4 mm in diameter)], black or brown.

Iconography:—Carretero (1990: 563, Lám. 170f–j).

Phenology:—Flowering from June to October.

Habitat:—Uncultivated land, roadsides, cultivated fields, rubbles.

Elevation:—50–1314 m a.s.l.

Chromosome number:—2n = 32, 34 (Weaver & McWilliams 1980, Hindáková & Schwarzova 1987 from Slovakia, Hügin 1987, Pal & Pandley 1989, Kiehn *et al.* 1991 and Vitek *et al.* 1992 from Austria, Greizerstein *et al.* 1997, Sheidai & Mohammadzdeh 2008, Ramesh & Kumar 2009).

Alien status:—Neophyte species native to North and South America, it can be considered invasive in Italy, causing threats in cultivated fields by loss of crop efficiency (economical impact) and urban gardens.

Occurrence in Italy:—Northern Italy [invasive in LOM, naturalized in FVG, TAA, VEN [Masin & Scortegagna (2012) reported *A. powellii* as casual alien for central and southern VEN], VDA (Iamonico & Bovio 2010, 2013), EMR (Bracchi & Romani 2010), casual in PIE (Iamonico *et al.* 2010b), and LIG (Iamonico 2014e)], while in Central and Southern Italy only in LAZ (Iamonico 2009b), and ABR (Conti & Tinti 2008, Iamonico *et al.* 2011b) as naturalized, and in CAM (Iamonico & Del Guacchio 2011) as casual.

Taxonomic annotations:—The usage of the name *A. powellii* changed over time, showing a large disagreement among the authors. Its morphological variability (structure and size of the synflorescence, length of the floral bracts, ratio length bract/tepals, and dehiscence/indehiscence of the fruits) was differently interpreted: some authors (e.g., Sauer 1967, Carretero 1990, Akeroyd 1993, Celesti-Grapow *et al.* 2010, Conti *et al.* 2007) accepted *A. powellii* in a broad sense, including it within *A. bouchonii*, while others maintained both as separate species (e.g., Pignatti 1982, Hügin 1987, Wilkin 1992, Mosyakin & Robertson 1996, Conti *et al.* 2005), or as a separate subspecies (e.g., Costea *et al.* 2001a, Iamonico 2008d). According to the morphological study by Costea *et al.* (2001a), *A. bouchonii* is clearly distinct on the basis of the following characters: synflorescence structure, ratio length bract/tepals, dehiscence/indehiscence of the fruit, ratio length/width of the fruit, and seed surface. Concerning the dehiscence/indehiscence of the fruit, Costea *et al.* (2001a) highlighted that "Studying European plants we found the indehiscent character of the fruit to be constant. For example, European plants of *A. bouchonii* cultivated for eight years in the vicinity of *A. powellii*, *A. hybridus* and *A. retroflexus*, in the Botanical Garden of the University of Agronomical Sciences Bucharest, maintained their character". Also karylogical studies and data on the nuclear DNA content (Greizerstein & Poggio 1992, Greizerstein *et al.* 1997) showed that *A. powellii* and *A. bouchonii* are distinct for chromosome number, chromosomal asymmetry and total DNA. A recent biometric study by Iamonico (2012a) confirms the morphological separation observed by Costea *et al.* (2001a), and reveals the existence of a third unit (*A. cacciatoi*, proposed at subspecific rank) first described by Cacciato (1966) from Rome (Central Italy). The three taxa differ in synflorescence structure, length of the main florescence, ratio length bract/tepals, flower symmetry, and dehiscence/indehiscence of the fruit. Today, two of them taxa (*A. powellii*, and *A. bouchonii*) are spread by man all over the world and the original distribution ranges are blurred. In order to reflect the different evolutionary histories, I prefer to recognize them at species rank, according to Hügin (1987).

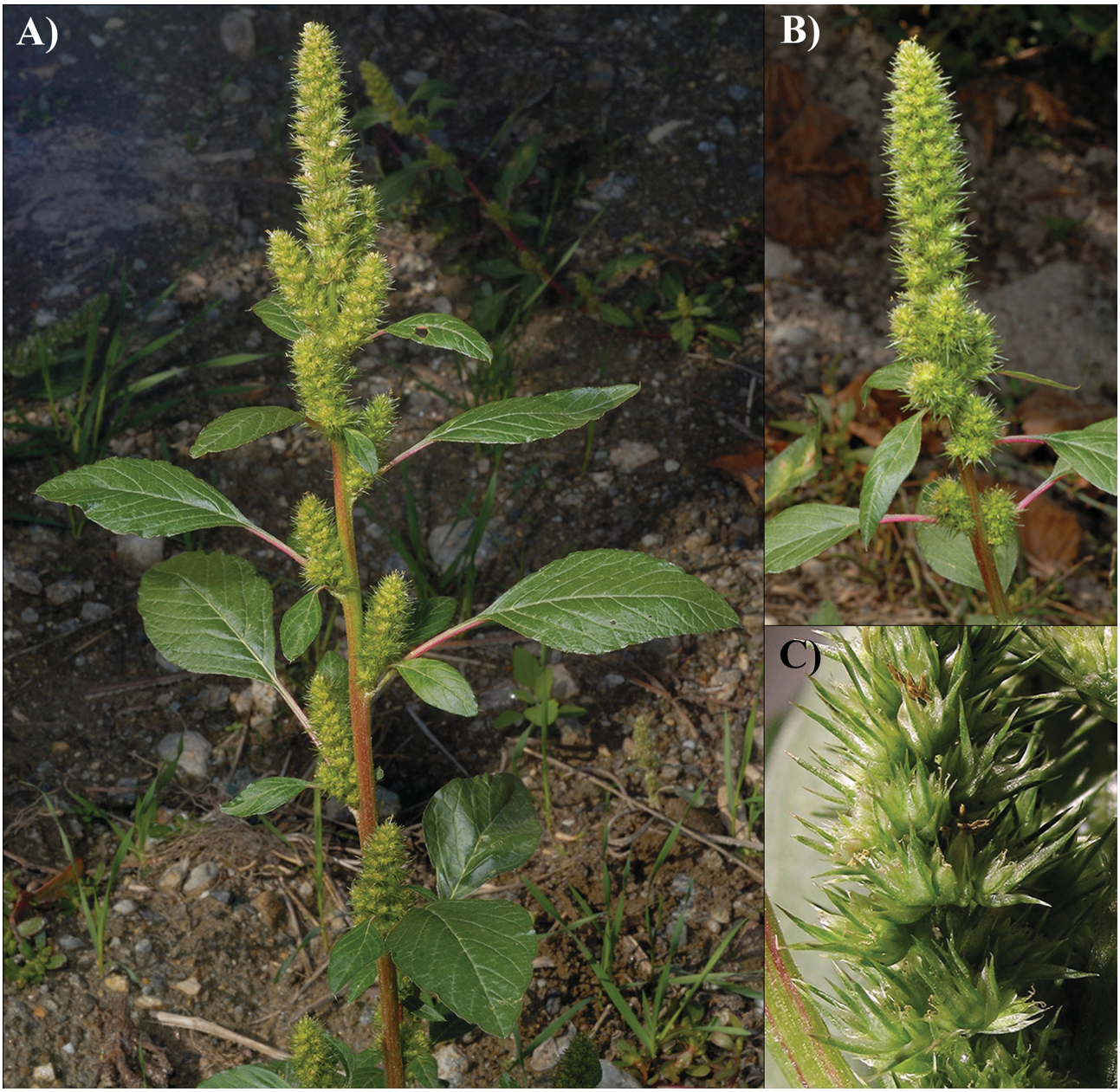

FIGURE 27. *Amaranthus powellii*: **A)** individual, **B)** synflorescence (Valle d'Aosta, Aosta province, Saint-Pierre locality, vineyard), **C)** detail of flowers (Lazio, Rome province, Rome city, footway). [photos by M. Broglio (**A**−**B**), and D. Iamonico (**C**)].

Specimina Visa Selecta:—ITALY. **Abruzzo**: nei pressi di Barrea, ambienti ruderali, 1000−1100 m a.s.l., 29 October 1995, *Conti 24499* (APP!); L'Aquila, lago di Campotosto, pascoli, 1314 m a.s.l., 8 September 2002, *Tinti 24499* (APP!); Fossa (Aquila), fiume Aterno sotto fossa, sponde, 570 m a.s.l., 2 September 2007, *Bartolucci 26767* (APP!); Tione degli Abruzzi, lungo il F. Aterno, margine di strada, 501 m a.s.l., 25 September 2007, *Bartolucci & Di Santo 28204* (APP!); Recolle (Gagliano Aterno), cava, 650 m a.s.l., 25 Septemebr 2007, *Di Santo & Bartolucci 28345* (APP!); Calanchi di Atri (Atri), argille, 315 m a.s.l., 5 October 2008, *Bartolucci 34759* (APP!). **Campania**: Salerno, Marina di Camerota, loc. Contrada Monte di Luna, oliveto abbandonato lungo il tratturo per raggiungere la spiaggia Pozzallo (Cala Bianca), 85 m a.s.l., 11 August 2009, *Iamonico s.n.* (HFLA!); Salerno, San Mango Piemonte, Autostrada A3, stazione di servizio "Salerno Ovest", aiuola nel parcheggio adibito ai pullman, 150 m a.s.l., 16 August 2009, *Iamonico* (HFLA!); Avellino, Atripalda, località Orto dei Preti, margini stradali, 320 m a.s.l., 8 October 2009, *Del Guacchios.n.* (*Herb. Del Guacchio*!). **Friuli-Venezia Giulia**: Udine, Villa Santina, 2 September 2001, *Poldini s.n.* (TSB!). **Lazio**: Roma, Parco Urbano di Aguzzano, Terreno da riporto, 100 m a.s.l., 8 September 2007, *Iamonico* (HFLA!, RO!); Roma, Albano Laziale frazione Cancelliera, massicciate ferroviarie, nei

pressi dell'incrocio con Via Cancelliera, 650 m a.s.l., 6 September 2008, *Iamonico* (HFLA!); Roma, Valmontone, incolto al margine della Strada Vicinale della Vecchia, nei pressi della stazione ferroviaria, 15 September 2008, *Iamonico* (HFLA!). **Liguria**: Savona, sul letto del fiume Letimbro, 3 August 1970, *Catanzaro s.n.* (RO!); Albenga, lungo le sponde del fiume Genta nel tratto che dal centro urbano porta alla foce, 18 August 1970, *Catanzaro s.n.* (RO!). **Lombardia**: Milano, San Siro, la montagnetta, 29 October 1952, *Piazzoli 4465* (MSNM!); Milano, zona 18 Baggio, via Valle Antrona, di fronte al civico 8, aiuola semiruderale, 120 m a.s.l., summer 1993, *Galasso 33853* (MSNM!). **Piemonte**: Alessandria, Isola di S. Antonio, Capraglia a lato del Po, 1 October 1981, *Soldano* 999 (*Herb. Soldano*!); Alessandria, Cassinelle, bivio per loc. Bandita, 482 m a.s.l., 2 Semptember 2008, *Tisi s.n.* (TO!); Druogno, bordo strada, 1050 m a.s.l., 9 Septemebr 2010, *Antonietti s.n.* (*Herb. Antonietti*!). **Trentino-Alto Adige**: sopra Pederzano (Vallagarina, Trentino, Italia), in un vogneto, 450 m a.s.l., 1 September 1984, Prosser *0032/3* (ROV!); lungo l'Adige presso Campagnola di Ala (Trento), sponda sabbioso-umida, 138 m a.s.l., 14 September 1991, *Prosser 0231/2* (ROV!); Bozen, 0,45 km ESE Etschbrücke in Sigmundskron, Nähe Bahnübergang, Ruderalflur, 240 m a.s.l., 23 July 1998, *Wilhalm s.n.* (BOZ!); Bozen, Feldthurns, Schrambach, Villnösser Haltestelle, Rand der Bahnstrecke, 530 m a.s.l., 22 August 2002, *Hilpold s.n.* (BOZ!); Bozen, Naturns, Bad Kochenmoos (Staben), 1,4 km WNW Bad Kochenmoos am E- Fuß der Auffahrt zum Tunnel, Grobschotter am Ende einer Entwässerungsrinne, 555 m a.s.l., 14 August 2003, *Zemmer PVASC2060* (BOZ!); Trento, Vallarsa, Piano di Vallarsa, campo lungo la stradina per Poiani, campo a riposo, 890 m a.s.l., 25 October 2005, *Prosser 0232/2* (ROV!); Bozen, Völs am Schlern, Prösels, Hügel des Pulverturmes, S-Seite, beim Aufsteig im Bereich des letzten Hauses, Hügel des Pulverturmes, S-Seite, beim Aufsteig im Bereich des letzten Hauses, ruderaler Trockenrasen, 880 m a.s.l., 7 September 2007, *Wilhalm PVASC12026* (BOZ!); Bozen, Jenesien, Tschögglberg, Jenesien, Oberglaning, 0,15 km N(NW) Perlegg Höfe, Waldweg (Porphyr), 1000 m a.s.l., 11 October 2008, *Wilhalm* (BOZ!); Trento, Trento, 03 September 1890, *Gelmi s.n.* (TR!); Trento, Piano di Vallarsa: campo lungo la stradina per Poiani, Campo a riposo, 890 m a.s.l., 25 October 2005, *Prosser s.n.* (ROV!). **Veneto**: Padova, Tra Faedo e Fontanafredda in una cascina (Colli Euganei, provincia di Padova, Italia), su macerie, 100 m a.s.l., 7 August 1989, *Prosser s.n.* (ROV!); Verona, comune di Branzone a SE di Pasola, in loc. Casarole, 420 m a.s.l., 26 October 2006, *Bertolli & Prosse 0330/* (ROV!); Verona, Navene, lungolago a N delle Terme, Scarpata ghiaiosa, 67 m a.s.l., 9 November 2006, *Bertolli, Prosser*, det. *Prosser 0231/1* (ROV!); Verona, Malcesine, tra Navene e loc. Martora, al nuovo porto, terreno da riporto, 67 m a.s.l., 9 November 2011, *Bertolli & Prosser 0131/3* (ROV!). **Valle d'Aosta**: Valgrisenche, *s.d.*, *Vaccaris.n.* (FI!); Str. Aymavilles, Vieille, 800 m a.s.l., 3 August 1971, *Merlo s.n.* (TO!); Saint Vincent, about 600 m, 24 August 1971, *Cacciato s.n.* (RO!); Pollein, incolti nel piano a ovest di Grand Pollein, 550 m a.s.l., 20 September 1990, *Bovio et Rosset s.n.* (AO!); Saint-Rhémy-en-Bosses, Route Nationale du Grand Saint Bernard, oltre il ponte quota 1730 in direzione nord ovest, 1735 m a.s.l., 19 Septemebr 1999, *Cerutti s.n.* (*Herb. Cerutti*!); Saint-Rhémy-en-Bosses, strada per Cerisey, tornante con cabina elettrica, 1435 m a.s.l., 10 Septemebr 2000, *Cerutti s.n.* (*Herb. Cerutti*!); Aosta, Saint-Pierre, nelle vigne del Mont Torrette, 29 September 2006, *Bovio* et *Broglio s.n.* (FI!); Arvier, loc. Montaverain salendo tra i terrazzamenti delle vigne abbandonate, 750 m a.s.l., 14 June 2012, *Bovio s.n.* (*Herb. Bovio*!).

24. *Amaranthus bouchonii*[1] Thell., Monde Pl. 27(160): 4−5. 1926 (Fig. 28).

≡ *Amaranthus powellii* S.Watson subsp. *bouchonii* (Thell.) Costea & Carretero in Costea & al. Sida 19(4): 964. 2001.
Type (lectotype designated by Iamonico 2015):—FRANCE. Bordeaux, 25 September 1925, *Bouchon s.n.* (US-106237!).
Isolectotype (designated here):—FRANCE. Bordeaux, 25 September 1925, *Bouchon s.n.* (Z-000000239!). Image of the isolectotype available at http://www.herbarien.uzh.ch/static/database/details_en.php?&spTypFlg=&spBarCod=Z-000000239&spHer

Description:—Herbs (5–)8−10(−12) dm tall, monoecious, annual (therophyte). Stems erect, glabrous (slightly pubescent in the synflorescence region), usually green, branched. Leaves green, ovate-lanceolate, more or less rhomboidal [(2.0–)5.0–12.0(–20.0) × (1.0–)2.5–6.0(–8.0) cm], with entire margins, apex obtuse, sometimes mucronate, base cuneate, glabrous (sometimes pubescent on the veins), petioled [petiole (2.0–)3.0–10.0(–15.0) cm long]. Synflorescences terminal, panicle-like, lax and not erect with many lateral branches, the main florescence

1. A. Bouchon, French botanist, first collector of this taxon (25th September 1925), along the left bank of the river Garonne, near Bordeaux (locus classicus).

(2−)5−20 cm long (longer than the paraclades), green or reddish. Floral bracts green to yellowish, lanceolate (1.9–4.4 × 0.2−0.9 mm), longer than the perianth, acute, awned, with membranous border narrowing to apex, margin entire, glabrous. Staminate flowers with 5 tepals, lanceolate; stamens 3–5. Pistillate flowers with 5 usually unequal tepals (zygomorphic flowers), lanceolate (0.7–2.3 × 0.2–0.7 mm), with acute and mucronate apex, without or with inconspicuous median vein; stigmas 3; ratio bract/tepal length 1.2–2.3. Fruit brown, ellipsoidal or subglobose (0.8–1.4 × 0.7–1.5 mm) as long as the perianth, slightly rugose, indehiscent. Seed lenticular (0.4–1.2 mm in diameter), black or brown.

Iconography:—Ardenghi & Parolo (2010: 71, figure 6a, c, d).

Elevation:—20–600 m a.s.l.

Chromosome number:—2n = 32 (Pogan *et al.* 1982, Hügin 1987, Greizerstein *et al.* 1997).

Chorology:—There is disagreement about the origin of this taxon. Some authors (e.g., Costea *et al.* 2001a) consider *A. bouchonii* of western European origin, maybe evolved in France, while others (e.g., Conti *et al.* 2005 for Italy) indicated it as alien. The origin of *A. bouchonii* still remains uncertain, and need further studies.

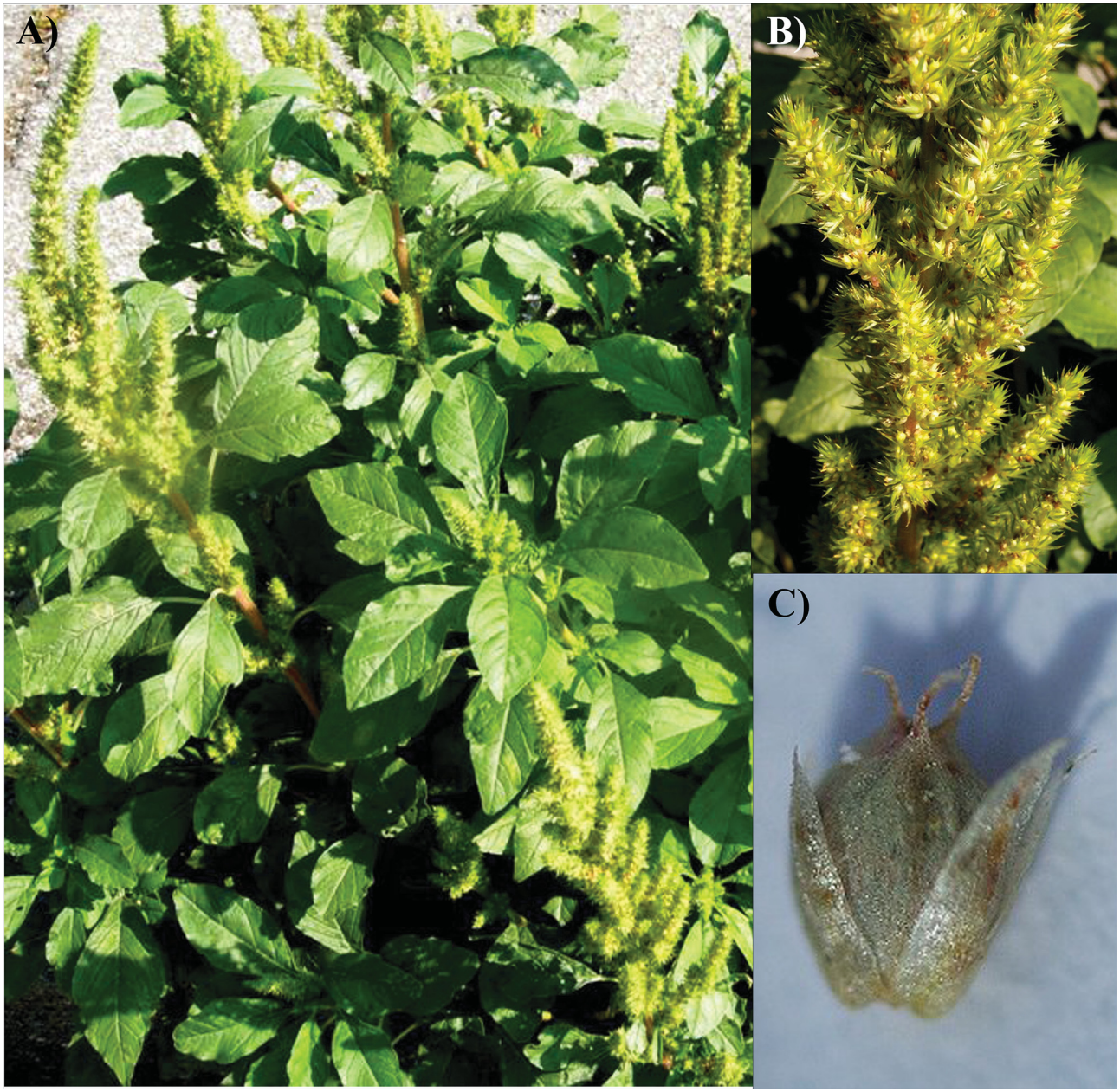

FIGURE 28. *Amaranthus bouchonii* (Toscana, Prato province, Montemurlo locality, footway): **A)** individual, **B)** synflorescence, **C)** detail of flowers [photos by N. Messina (**A**−**B**), and D. Iamonico (**C**)].

Occurrence in Italy:—Northern Italy: FVG, TAA, VEN (Iamonico 2009i), EMR (Ardenghi & Parolo 2010, Iamonico & Ardenghi 2013), LOM, PIE, LIG, and TOS (Iamonico 2012b, Iamonico *et al.* 2011a). If *A. bouchonii* is considered alien for Italy, it is naturalized in FVG, TAA, LOM, PIE, and LIG and casual in VEN, EMR (Iamonico & Ardenghi 2013), and TOS.

Taxonomic annotations:—See *A. powellii*.

Taxonomic annotations:—Iamonico (2015) lectotypified the name *Amaranthus bouchonii* on a specimen preserved at US. Further herbarium investigations revealed the presence at Z of an exsiccatum (no. 000000239) bearing a terminal part of one plant collected by A. Bouchon, which is an isolectotype.

Specimina Visa Selecta:—ITALY. **Emilia-Romagna**: Piacenza, Castel San Giovanni, via Malvicino all'altezza di via Borgo Boito lato S della strada, ciglio stradale alla base del muretto di cinta di un pollaio, 79 m a.s.l., 2 September 2010, *Ardenghi 001120* (*Herb. Ardenghi*!). **Friuli-Venezia Giulia**: Udine, Gemona, October 1992, *Poldini AB9744* (TSB!); Udine, Magnano in Riviera, 200 m, 11 October 1992, *Danelutto s.n.* (FI!); Udine, Arcano superiore, campi, 18 October 1995, *Danelutto 9844/3* (TSB!); Udine, Sacile, San Giovanni di Livenza, 4 September 1998, *Poldini 0041/3* (TSB!); Udine, Gemona, October 1992, *Poldini 9744* (TSB!). **Liguria**: Santo Stefano Magra (La Spezia), greto lungo la sponda sinistra del fium Magra, 19 August 1981, *Soldano 3601* (*Herb. Soldano*!); La Spezia, margine sinistro del fiume Magra, poco a monte della confluenza col fiume Vara, nei dintorni di Sarzana, 20 m a.s.l., 27 July 1982, *Marchetti s.n.* (MRSN!); **Lombardia**: Milano, area Scalo Sempione, September 1939, *Ceroni s.n.* (PAV!); Como, manicomio, orto, October 1940, *Ceroni s.n.* (PAV!); Spessa (Pavia), lanca prima del Po, 2 October 1979, *Soldano 2827* (*Herb. Soldano*!); Como, strada Gemù-Brezzova, presso un tornante a DS. (sulla DS. salendo), rudereto, 600−700 m a.s.l., 31 August 1989, *Galasso 23248* (MSNM!); Como, Sormano, Valle della Roncaglia, sentiero pedonale… presso l'area Pic nic, 830 m a.s.l., 1 September 1990, *Galasso 24376* (MSNM!); Milano, zona 18 Baggio, via Albona: numero dispari, tra via A. da Gandino e via Cabella, marciapiede presso il cordolo che separa l'aiuola, 120 m a.s.l., 8 November 1991, *Galasso* (MSNM!); Cremona, Crema, cascina Ca' delle Mosche, 29 July 1995, *Giordana s.n.* (*Herb. Giordana*!); Cremona, Romanengo, località Naviglio di Melotta, 8 August 1999, *Giordana s.n.* (*Herb. Giordana*!); Sondrio, stradina tra Viale Adua e il ponte della ferrovia, destra idrografica del torrente Mallero, gradini, 29 June 2009, 299 m a.s.l., *Ardenghi & Parolo 001158* (*Herb. Ardenghi*!); Ardenno (Sondrio), invaso, destra idrografica del fiume Adda, cumulo di terra con *Chenopodium album* L., 3 August 2010, 260 m a.s.l., *Ardenghi & Parolo 001050* (*Herb. Ardenghi*!); Traona (Sondrio), Via Valeriana (SP4), margine stradale, 221 m a.s.l., 23 October 2010, *Ardenghi, Parolo & Gariboldi 001034* (*Herb. Ardenghi*!); **Piemonte**: Vercelli, lato sponda destra del Sesia a monte del ponte ferroviario, 130 m a.s.l., 15 November 1979, *Soldano 2482* (Herb. Soldano!); Palazzolo (Vicenza), sponda del Po, 19 August 1980, *Soldano 3364* (*Herb. Soldano*!); Castagneto (Torino), sponda del Po di fronte a Chiasso, 29 August 1981, *Soldano 3591* (*Herb. Soldano*!); Busto Arstizio (Varese), luogo incolto alla periferia della città, poco distante dal cimitero, 28 October 1981, *Abbà 89* (MRSN!); Cressa (Novara), incolto verso Borgomanero, 25 September 1982, *Abbà 89* (MRSN!); Genola (Cuneo), distante dal paese presso una casa isolata di recente costruzione, 9 September 1981, *Abbà 88* (MRSN!); San Sebastiano Po (provincia di Torino), nei pressi del Po, 16 September 1981, *Abbà 3342* (MRSN!); Santena (Torino), lungo una strada nei pressi del centro abitato, 2 November 1981, *Abbà 389* (MRSN!); argine sinistro del fiume Magra, poco a monte della confluenza col fiume Vara, nei dintorni di Sarzana (provincia di La Spezia), 20 m a.s.l., 1983, *Marchetti 2422* (MRSN!); Novara, Cureggio, in luogo incolto presso Fontaneto d'Aragona, 30 September 1983, *Abbà 89* (MRSN!); Carmagnola (Torino), nell'orto della stilleria del liquore Alpestre, 22 July 1989, *Abbà 92* (MRSN!); Molino dei Torti (Alessandria), Incolto presso l'abitato del paese, 6 September 1989, *Abbà* (MRSN!); Vercelli, a lato della riva destra del Sesia a monte del ponte ferroviario, 15 October 1979, *Soldano s.n.* (*Herb. Soldano*!); Vercelli, al lato riva N della Sesia a monte ponte FF.SS., October 1980, *Soldano 3236* (*Herb. Soldano*!); Domodossola, lato strada verso N, September 1983, *Soldano 4574* (*Herb. Soldano*!); Vogogna, a monte di Cantone, sabb. (golena in sin. Del Toce), 225 m a.s.l, *Antonietti s.n.* (*Herb. Antonietti*!); Domodossola, via Girola lato sin., tra muro e marciapiede, 265 m a.s.l., 21 July 2001, *Antonietti s.n.* (*Herb. Antonietti*!); Drougno, Coimo, campetto a riposo, 815 m a.s.l., 22 September 2003, *Antonietti s.n.* (*Herb. Antonietti*!); Trontano, golena F. Toce, terreno ciottoloso, 250 m a.s.l., 15 August 2006, *Antonietti s.n.* (*Herb. Antonietti*!); Domodossola, a mont siberia, incolto ruderale (bordo deposito letame), 245 m a.s.l., 10 September 2007, *Antonietti s.n.* (*Herb. Antonietti*!); Alessandria, Fugarolo, pianura, 94 m a.s.l., 25 August 2008, *A. Tisi s.n.* (*Herb. Tisi*!); Domodossola, sedime ferrov. A valle ponte da via Piave, ruder., 27 m a.s.l., 26 September 2011, *Antonietti s.n.* (*Herb. Antonietti*!). **Toscana**: Carrara, colonia marina, 20 August 1981, *Soldano 3643* (*Herb.*

Soldano!); Massa, cinque vie, 5 October 1975, *Soldano s.n.* (*Herb. Soldano*!); Carrara, colonia a Marina, 20 August 1981, *Soldano* (*Herb. Soldano*!). **Trentino-Alto Adige**: Vigneto a SW di Borghetto (a S di Avio) (TR), 135 m a.s.l., 17 September 1991, *Prosser 0331/2* (FI!); *ibidem* (ROV!); Ds. Brenta subito oltre il ponte a SE della stazione ferrov. di Ospedaletto (Valsugana), campo di mais, 305 m a.s.l., 30 August 1992, *Prosser 9935/4* (ROV!); Provincia di Trento, loc. Colle a circa 500 m a N di Mori, in campo di patate, 605 m a.s.l., 15 August 1999, *Prosser s.n.* (ROV!); Valsugana presso Pegine, spanda destra del Fersina a Sud di Serso, campo a riposo, 520 m a.s.l., 5 September 1999, *Prosser 9933/2* (ROV!); Bozen, Siebeneich (Terlan), Margarethenwald 0.4 km NW Darumhof, ruderalstelle, 270 m a.s.l., 8 October 2004, *Stockner PVASC5127* (BOZ!); Bozen, Neumarkt, Parkplatz Sportzone 0,85 km NNW Dorfzentrum, kiesig-sandiger Wegrand, 218 m a.s.l., 22 October 2004, *Wilhalm PVASC5430* (BOZ!). **Veneto**: Belluno, Feltre, stazione FFSS, 14 August 1985, *Lasen 9937/3* (*Herb. Lasen*!); Provincia di Verona, Sommacampagna, alla stazione ferrov. di Sommacampagna-Sona, 100 m a.s.l., 20 September 2001, *Prosser s.n.* (ROV!).

Doubtfully occurring species

A. *Amaranthus crassipes* Schltdl., Linnaea 6: 757. 1831.

Description:—Herbs 2–6 dm tall, monoecious, annual (therophyte). Stems prostrate or ascending, glabrous, branched. Leaves ovate to lanceolate, with entire or slightly undulate margins, apex obtuse to emarginate, mucronate, base cuneate, glabrous, petioled. Synflorescences arranged in axillary glomerules. Floral bracts ovate-deltate (0.5–0.9 mm long), shorter than the perianth. Staminate flowers with 5 tepals; stamens 3–5. Pistillate flowers with (4−)5 tepals, lanceolate-spathulate (2.0–3.0 mm long), with usually acute and mucronate apex; stigmas 2(−3). Fruit ellipsoidal (2.0–3.0 mm long), about as long as the perianth, rugose, indehiscent. Seed lenticular, dark-brownish to reddish-black.

Iconography:—Aellen (1959: 470, figure 212), Mosyakin & Robertson (2003).

Alien status:—Neophyte species native to South America.

Occurrence in Italy:—Fiori (1923) reported *A. crassipes* as alien in CAL (Southern Italy) in the locality Gioia Tauro (Reggio Calabria province). Zangheri (1976), Pignatti (1982), and Conti *et al.* (2005, 2007) did not list it. Celesti-Grapow *et al.* (2009a, 2010) indicated *A. crassipes* as formerly recorded in CAL region. However, no specimens collected in Italy were found, except for one exsiccatum from the Botanical Garden of Pisa [*Amaranthus crassipes* Schlecht...in H. Pisano…1839, *G. Savi s.n.* (FI!)] that very likely refers to a cultivated plant. Therefore, the occurrence in Italy of this species is doubtful.

B. *Amaranthus graecizans* L. subsp. ***graecizans*** (see also discussion under *A. graecizans* s.l. at page 34).

Description:—Similar to *A. graecizans* subsp. *sylvestris*, but leaf blade lanceolate [(2.0−)3.0−5.0(−6.0) × 0.5−1.0 cm], ratio length/width of the blade 3.0−6.0.

Chorology:—Native to Europe.

Occurrence in Italy:—Fiori (1923) indicated for *A. graecizans* var. *typicus* (that corresponds to the nominal taxon) "…forse avvent. da noi…" ("…maybe alien in our country…"), so doubtfully recording it. Pignatti (1982) accepted the varietal rank, also indicating *A. graecizans* as doubtful: "Da noi solo sporadico nel Veneto (?). Segnalato frequentemente però certo per confusione con la var. successiva [var. *sylvestris*] e con 392 [*A. blitoides*]" ("In Italy only rare in Veneto (?). Often recorded but certainly in confusion with the following variety [var. *sylvestris*] and with 392 [*A. blitoides*]"). Other authors (e.g., Zangheri 1976, Conti *et al.* 2005, 2007, Celesti-Grapow *et al.* 2009a, 2009b, 2010) have not recognized infraspecific ranks for *A. graecizans*. Although no Italian specimen of *A. graecizans* s.s. was found, it is possible that this taxon occurs in Italy, especially in the northeastern part of the country.

Hybrids

Hybridization is quite common in the genus *Amaranthus*, especially among the cultivated and wild taxa belonging

to the subgenus *Amaranthus* (e.g., Costea *et al.* 2001a, 2003), but also among representatives of the subgenera *Amaranthus* and *Acnida* (e.g., Sauer 1955, Gaines *et al.* 2012). Experimental hybridizations (Murray 1940, Greizerstein & Poggio 1992, Greizerstein *et al.* 1997) showed that the flowers of F1 plants are mostly sterile (usually 80–98%). Due to the low number of fertile female flowers, hybrids can often be recognized by the high number of densely packed bracts. The hybrids have sometimes abnormally formed synflorescences with very dense and twisted paraclades. In these cases, the morphological characters are not always strictly intermediate between the parents; a good way to identify them is to observe and identify the putative parent taxa in the field. Other authors (e.g., Trucco & Tranel 2011) highlighted that the significant occurrence of hybrids in nature indicates that the F1 generation could be fertile. Molecular studies may be useful to clarify these aspects.

Several hybrids were described by European authors (e.g., Thellung 1914, Priszter 1958, Aellen 1959, Cacciato 1967, 1969), although some American works (e.g., Mosyakin & Robertson 2003) stated that hybridization events were overestimated in Europe. However, hybridization in *Amaranthus* is a well documented phenomenon (e.g., Lanta *et al.* 2003, Gaines *et al.* 2012) and probably it is part of the mechanism of evolution in the genus, at least for some taxa (e.g., Trucco & Tranel 2011).

The hybrids recorded in Italy are listed here, using Roman numbers (see also Iamonico 2008b). Six out of the seven hybrids have originated from taxa within subgenus *Amaranthus*, while only one (*A.* × *mauritii*) has parents (*A. viridis*, and *A. deflexus*) belonging to subgenus *Albersia*.

I. *Amaranthus* × *aellenii* Cacciato, Giorn. Bot. Ital. 101: 404. 1968. (*A. cruentus* × *A. cacciatoi*).

Type:—ITALY. Lazio: Roma, pressi di Cinecittà, ruderati, 04 November 1967, *Cacciato s.n.* (holotype RO!, isotypes RO!).

Description:—Herbs monoecious, annual (therophyte). Stems erect, green to brownish, glabrous below, slightly pubescent in the distal part, branched, the branches erect-patent giving to the plant a pyramidal shape. Leaves green, ovate to ovate-lanceolate, rhomboidal or elliptic, with entire margins, apex obtuse, sometimes mucronate, base cuneate, glabrous, petioled. Synflorescences dense and terminal, panicle-like, with the main florescence equal to or longer than the paraclades. Floral bracts lanceolate, longer than the perianth, acute, awned, with membranous borders abruptly interrupted at the half, margin entire, glabrous. Pistillate flowers with 5 unequal tepals, spathulate, linear or lanceolate, mucronate or awned. Fruit ellipsoidal, dehiscent. Seed lenticular black or brown.

Comparison with parental taxa:—It differs from *A. cacciatoi* in having the flower zygomorphic. In comparison with *A. cruentus*, *A.* × *aellenii* has longer floral bracts.

Alien status:—Hybrid probably native to Europe (Italy?).

Occurrence in Italy:—LAZ (Cacciato 1967). The same author reported *A.* × *aellenii* from Rome (Lazio region, Central Italy).

II. *Amaranthus* × *galii* Sennen & Gonzalo in Sennen, Cavanillesia 2: 34. 1929. (*A. cruentus* × *A. retroflexus*).

Type:—not designated.

Description:—Herbs monoecious, annual (therophyte). Stems erect, green, slightly pubescent, branched. Leaves green, ovate to ovate-lanceolate, rhomboidal, with entire or undulate margins, apex acute or obtuse (sometimes slightly emarginate), mucronate, base cuneate, usually glabrous, petioled. Synflorescences terminal, panicle-like. Floral bracts lanceolate, longer than the perianth, acute, slightly awned, with membranous border narrowing to apex, margin entire, glabrous. Pistillate flowers mostly abortive with 5 tepals, obovate-spathulate. Fruit ellipsoidal, dehiscent. Seed lenticular, dark-brown or reddish-brown.

Comparison with parental taxa:—It differs from *A. cruentus* in having the stem more pubescent, the synflorescence with more densely arranged paraclades and main florescence and the longer floral bracts. In comparison with *A. retroflexus*, *A.* × *galii* has intensely green and less pubescent stems (never tomentose), and synflorescence with paraclades and main florescences that are longer and narrower.

Alien status:—Hybrid probably native to Europe (Spain?).

1. P.A. Aellen (1896–1973), Swiss botanist, studied the taxonomy, and nomenclature of Amaranthaceae and Chenopodiaceae in the 1950's and 1960's.

Occurrence in Italy:—LAZ (Cacciato 1966: 628). This nothotaxon is currently recorded only for Rome city, and in Baja d'Argento (Circeo, Latina Province).

Specimina Visa Selecta:—ITALY. **Lazio**: Roma, Largo Preneste, 25 August 1957, *Cacciato s.n.* (RO!); Roma, lungo la via Frascati, 12 August 1964, *Cacciato s.n.* (RO!); Roma, macerie sul ponte la stazione ferr. Prenestina, 20 August 1964, *Cacciato s.n.* (RO!); Roma, lungo la via Demetriade nei pressi del Quadraro, strada assai polverosa, 2 October 1964, *Cacciato s.n.* (RO!); Roma, su marciapiede sterrato i Via Curzio Rufo a Cinecittà, 10 October 1964, *Cacciato s.n.* (RO!); Roma, Cinecittà, 14 August 1965, *Cacciato s.n.* (RO!).

III. ***Amaranthus* × *mauritii*** Sennen, Diagn. Nouv. 114. 1936. (*A. viridis* × *A. deflexus*).

Type (lectotype, designated here):—MOROCCO. Melilla: lieux vagues, marges, 08 August 1930, *Mauricio 7702* (MPU-008273! image available at http://www.herbier-mpu.org/zoomify/zoomify.php?fichier=MPU008273). Isolectotype (designated here): MOROCCO. Melilla: lieux vagues, marges, 08 August 1930, *Mauricio 7702* (MPU-008274! image available at http://www.herbier-mpu.org/zoomify/zoomify.php?fichier=MPU008274).

= *Amaranthus* × *mauritii* f. *ramosissima* Sennen *syn. nov.*

Type:—MOROCCO. Melilla: alentours de la ville, sites vagues, 10 July 1930, *Sennen & Mauricio 7703* (holotype MPU-008272! image of the holotype available at http://www.herbier-mpu.org/zoomify/zoomify.php?fichier=MPU008272).

Description:—Herbs monoecious, perennial (hemicryptophytes). Stems prostrate to ascending, brownish to reddish, glabrous (sometimes slightly pubescent in the upper part), branched. Leaves green to dark-green, ovate, deltoid, with entire margins, apex usually obtuse, sometimes mucronate, base cuneate, glabrous, petioled. Synflorescences terminal, spike- or panicle-like, the main florescence 0.5−2.0 cm wide, not slender, usually longer than the paraclades. Floral bracts lanceolate to linear, shorter than the perianth, acute, mucronate, margin entire, glabrous. Pistillate flowers with 2(−3) tepals, lanceolate to linear. Fruit subglobose, slightly rugose, as long as the perianth, indehiscent. Seed lenticular, black, or dark-brown.

Comparison with parental taxa:—It differs from *A. deflexus* in having the fruit subglobose (never pear-shaped). In comparison with *A. viridis*, *A.* × *mauritii* has the main florescence not slender and wider, and the perianth with usually 2 tepals.

Alien status:—Exotic hybrid probably native to Africa (Morocco?).

Occurrence in Italy:—LAZ. This nothotaxon is here recorded for the first time in Italy (Rome city). This record also represents the first occurrence in Europe.

Taxonomic annotations:—Sennen (1936) described this hybrid providing a diagnosis, its provenance ("Maroc: Melilla au Jardin Valenciano, sites rudéraux"), the collectors ("Sennen et Mauricio"), and the date of collection ("1930"). Moreover, Sennen (1936) numbered the collection as "7702". There are two specimens at MPU (nos. 008273−008274), each bearing a printed label with this number, and all other information given into the protologue; there is no doubt that they are syntypes (art. 9.5 of the ICN). According to the arts. 9.5, and 9.2 I designate as lectotype the specimen no. 008273, while the other exsiccatum is a isolectotype. Concerning f. *ramosissima*, it was described by Sennen (1936) from plants collected in the same locality as the nominal taxon to distinguish plants that are more branched. A single specimen is preserved at MPU (no. 008272) bearing a printed label which collection number ("*7703*") matches the protologue: this specimen is the holotype for the name *A.* × *mauritii* f. *ramosissima*. However, the branching pattern has no taxonomical value in both parents, and in all other taxa belonging to subgenus *Albersia*, and its variability is continuous. As a consequence, I consider this taxon as a heterotypic synonym of *A.* × *mauritii s.s.* (new synonymy).

Specimina Visa Selecta:—ITALY. **Lazio**: Roma, Arco di Travertino, marciapiedi, 5 June 2014, *Iamonico s.n.* (HFLA!).

IV. *Amaranthus* × *montelucciі*[1] Cacciato ex Iamonico, Pl. Biosystems: in press. 2015. (*A. cacciatoi* × *A. hybridus*[2]).

1. G. Montelucci (1899-1983), Major General of the Italian Air Force and a botanist in the 1960's and 1970's. His researches were mainly focused on phytogeography, geobotany and plant sociology.

2. Cacciato (1969) indicated as parents *A. bouchonii* Thell. [plants from Rome, so the author referred to his var. *cacciatoi*] and *A. chlorostachys* Willd. var. *aciculatus* (Thell.) Aellen (1961: 482) [basionym: *A. hybridus* f. *aciculatus* Thellung (1914: 238)] that can be considered a synonym of *A. hybridus* according to Iamonico (2014c) and African Plant Database (2012).

– *Amaranthus* × *monteluccii* Cacciato, Inform. Bot. Ital. 1: 112. 1969, *nom. inval.* (Art. 40.1 of ICN, McNeill *et al.* 2012). Type:—ITALY. Lazio: Roma, marciapiede al viale dei Consoli (Quadraro), 28 September 1968, *Cacciato s.n.* (holotype RO!).

Description:—Herbs monoecious, annual (therophyte). Stems erect, green, glabrous or nearly so, branched. Leaves green, ovate-lanceolate, rhomboidal, apex acute or obtuse, mucronate, base cuneate, usually glabrous, petioled. Synflorescences terminal, panicle-like, with the main florescence longer than the paraclades, green. Floral bracts lanceolate, slightly longer than the perianth (about 1.2 times), acute, awned, margin entire, glabrous. Pistillate flowers mostly abortive with 5 unequal tepals, usually acute. Fruit ellipsoidal, dehiscent. Seed lenticular, black.

Comparison with parental taxa:—It differs from *A. cacciatoi* in having the tepals unequal (zygomorphic flowers). In comparison with *A. hybridus*, *A.* × *monteluccii* has longer bracts [(3−4 mm vs. 2−3 mm, as reported by Thellung (1914: 238) for his *A. hybridus* f. *aciculatus*].

Alien status:—Hybrid probably native to Europe (Italy?).

Occurrence in Italy:—LAZ (Cacciato 1969: 113). The same author reported *A.* × *monteluccii* from Rome (Lazio region, Central Italy).

Specimina Visa Selecta:—ITALY. **Lazio**: Roma, 18 August 1968, *Cacciato s.n.* (RO!); *ibidem* (RO!); Roma, marciapiede al Viale dei Consoli (Quadraro), 28 September 1968, *Cacciato s.n.* (RO!); *ibidem* (RO!).

V. ***Amaranthus* × *ozanonii*** Thell. ex Priszter, Ind. Hort. Bot. Univ. Budapest. 7: 138. 1949. (*A. hybridus* × *A. retroflexus*).

Type:—not designated.

Description:—Herbs monoecious, annual (therophyte). Stems erect, green to reddish, ± pubescent, branched. Leaves green, ovate to ovate-lanceolate, rhomboidal or elliptic, with usually entire, apex acute or obtuse, mucronate, base cuneate, usually glabrous, petioled. Synflorescences dense and terminal, panicle-like, with paraclades 3-7 cm long. Floral bracts lanceolate, about 2 times longer than the perianth, acute, awned, margin entire, glabrous. Pistillate flowers mostly abortive with 5 tepals, spathulate. Fruit ellipsoidal dehiscent. Seed lenticular, dark-brown or reddish-brown.

Comparison with parental taxa:—It differs from *A. hybridus* in having the stem more pubescent, the synflorescence with shorter paraclades and main florescence, and the tepals spathulate. In comparison with *A. retroflexus*, *A.* × *ozanonii* has the stem less pubescent (never tomentose) and the synflorescence with paraclades and main florescence more densely arranged and longer.

Alien status:—Hybrid probably native to Europe.

Occurrence in Italy:—VEN, PIE (Iamonico *et al.* 2010b), LAZ (Cacciato 1966: 628), PUG.

Taxonomic annotations:—Some authors (e.g., Kerguelen 1993) indicate *A.* × *ozanonii* as a synonym of *A.* × *adulterinus* Thell., the latter having priority (see Arts. 11.4, and 11.9 of the ICN). Further studies on the types are required to verify this synonymization.

Specimina Visa Selecta:—ITALY. **Lazio**: Roma, scalo ferrov. Ostiense, October 1951, *Cacciato s.n.* (RO!); *ibidem*, 3 September 1960, *Cacciato s.n.* (RO!); Fiuggi, Rive del lago di Canterno nella zona di fango, 9 September 1965, *Cacciato s.n.* (RO!); Roma, a Prota Furba, 16 September 1965, *Cacciato s.n.* (RO!); Frascati, 2 October 1965, *Cacciato s.n.* (RO!); Roma, lungo un muro in via della Staz. Tiburtina, 12 October 1965, *Cacciato s.n.* (RO!); Latina, San Felice Circeo, 4 July 1966, *Cacciato s.n.* (RO!); Latina, Circeo (Baia d'Argento), 6 August 1966, *Cacciato s.n.* (RO!); Roma, sulla via di Casalberone, 12 November 1967, *Cacciato s.n.* (RO!); **Piemonte**: Torino, Corso Appio Claudio, margini stradali, 5 October 2007, *Barni s.n.* (TO!); **Puglia**: Lecce, S. Cesario, Via Vecchia Lequile, bordo strada, 24 September 1990, *Panzera s.n.* (LEC!). **Veneto**: Verona, Malcesine, tra Navene e loc. Martora, al nuovo porto, terreno da riporto, 67 m a.s.l., 9 November 2011, *Bertolli & Prosser 0231/1* (ROV!); Verona, Malcesine, sul lungolago in loc. La Madonnina, in un'aiuola, 67 m a.s.l., 6 November 2006, *Bertolli & Prosser 0231/1* (ROV!).

VI. ***Amaranthus* × *pyxidatus*** (Contré) Iamonico, *comb. et stat. nov.* (*A. retroflexus* × *A. cacciatoi*).

Basionym: *Amaranthus* × *ralleti* Contré var. *pyxidatus* Contré, Feuille Naturalistes 2: 11. 1947.
Type:—not designated.

Description:—Herbs monoecious, annual (therophyte). Stems erect, green to reddish, glabrous below, pubescent in the distal part, much branched proximally. Leaves green, ovate to ovate-lanceolate, rhomboidal, with entire to undulate margins, apex acute or obtuse, mucronate, base cuneate, usually glabrous, petioled. Synflorescences dense and terminal, panicle-like, with the main florescence clearly longer than the paraclades. Floral bracts lanceolate, longer than the perianth, acute or obtuse (not spathulate), awned, margin entire, glabrous. Pistillate flowers mostly abortive with 5 tepals, spathulate. Fruit ellipsoidal, dehiscent. Seed lenticular, black or brown.

Comparison with parental taxa:—It differs from *A. cacciatoi* in having the stem distally more pubescent. In comparison with *A. retroflexus*, *A.* × *pyxidatus* has the stem proximally glabrous, the main florescence clearly longer than the paraclades, and the tepals not spathulate.

Alien status:—Hybrid probably native to Europe (France?).

Occurrence in Italy:—LAZ (Cacciato 1967: 405). The same author reported *A.* × *pyxidatus* from Rome (Lazio region, Central Italy).

Taxonomic annotations:—Contré (1947) described two varieties for his *A.* × *rallentii*, var. *pyxidatus* (with fruit dehiscent), and var. *utriculatus* (with fruit indehiscent). Since the Italian populations from the Lazio region only include plants with dehiscent fruits (currently known as *A. cacciatoi*, see Iamonico 2012a, 2013d) they certainly refer to Contré's var. *pyxidatus*. I prefer to treat this nothotaxon at nothospecies rank, so I here propose a new combination.

Specimina Visa Selecta:—ITALY. **Lazio**: Roma, 16 October 1966, *Cacciato s.n.* (RO!); Roma, 24 October 1967, *Cacciato s.n.* (RO!); Roma, margini della strada in via Teano, 16 November 1967, *Cacciato s.n.* (RO!); Roma, rinvenuto alla borgata Gordiani, 16 November 1967, *Cacciato s.n.* (RO!); *ibidem* (RO!); Roma, rinvenuto a Casalbertone, 24 August 1968, *Cacciato s.n.* (RO!); *ibidem* (RO!); Roma, 4 October 1968, *Cacciato s.n.* (RO!).

VII. *Amaranthus* × *soproniensis* Priszter & Kárpáti, Ind. Hort. Bot. Univ. Budapest. 7: 140. 1949. (*A. powellii* × *A. retroflexus*).

Type:—not designated.

Description:—Herbs monoecious, annual (therophyte). Stems erect, green to light green (sometimes brownish), pubescent in the synflorescence part, branched. Leaves green (sometimes reddish), ovate to ovate-lanceolate, rhomboidal, with entire or undulate margins, apex acute or obtuse, mucronate, base cuneate, usually glabrous, petioled. Synflorescences terminal, panicle-like, the main florescence often 2−3 cm wide and up to 20−30 cm long, longer than the paraclades. Floral bracts lanceolate, longer than the perianth, acute, slightly awned, with membranous border narrowing to apex, margin entire, glabrous. Pistillate flowers mostly abortive with 5 tepals, spathulate. Fruit ellipsoidal, dehiscent. Seed lenticular, dark brown or reddish brown.

Comparison with parental taxa:—It differs from *A. powellii* in having the tepals spathulate. In comparison with *A. retroflexus*, *A.* × *soproniensis* has the stem less pubescent (never tomentose) and the main florescence longer than the paraclades.

Alien status:—Hybrid probably native to Europe (Spain?).

Occurrence in Italy:—LAZ (Cacciato 1966: 628). This nothotaxon is recorded in the localities Rome, Frascati, and Velletri (Rome Province), and the locality Fiuggi Fonte (Frosinone Province).

Specimina Visa Selecta:—ITALY. **Lazio**: Roma, Circo Massimo, 6 August 1959, *Cacciato s.n.* (RO!); Roma, Centocelle, 13 August 1961, *Cacciato s.n.* (RO!); Roma, a Cinecittà, 10 August 1964, *Cacciato s.n.* (RO!); Frascati, 2 October 1965, *Cacciato s.n.* (RO!); Roma, in un campo di fagioli all'Acqua Bulicante, 12 August 1966, *Cacciato s.n.* (RO!); Roma, lungo la via di Portonaccio, sul marciapiede, 14 August 1964, *Cacciato s.n.* (RO!); Roma, lungo i ruderi dell'acquedotto in Via Lemonia, 4 November 1977, *Cacciato s.n.* (RO!).

Conclusions

The present study represents the first comprehensive Italian work at national level.

From the nomenclatural point of view, several names previously treated by Italian authors as separated taxa [e.g., *A. tricolor* var. *tristis*, *A. tricolor* var. *mangostanus* or *A. hybridus* var. *patulus* by Fiori (1923) or *A. paniculatus* by Pignatti (1982)] or accepted as prioritary [e.g., *A. ascendens* by Fiori (1923) or *A. lividus* by Pignatti (1982)] or synonymized [e.g., *A. sylvestris* with *A. graecizans* by Zangheri (1976), or *A. bouchonii* with *A. powellii* by Celesti-Grapow *et al.* (2009a)] were corrected and updated according to Filias *et al.* (1980) and Iamonico (2014a, 2014b, 2015). As a consequence, 24 species (and 27 non-hybrid taxa at species and variety ranks) are currently recognized and recorded (see Table 1 for a comparison with the previous comprehensive Italian floras, and Table 3 for synoptical view of the regional occurrences). Seven hybrids have also been recorded.

From the taxonomical point of view, the examination of live plants and exsiccata revealed both misapplication of names and erroneous identifications. In some cases, even the family was not correctly identified, e.g., some exsiccata of *A. graecizans* that were recorded as *Parietaria judaica* L. (Urticaceae). As a consequence, the occurrence and degree of abundance of several taxa was over- or underestimated. A typical case is that of *A. emarginatus*, a taxon never recorded in Italy until 2004 (Wilhalm *et al.* 2004), not included in the recent checklists (Conti *et al.* 2005, 2007, Celesti-Grapow *et al.* 2009a, 2009b, 2010), but widespread in Italy, all across northern, central and southern regions. In some cases, the majority of the plants previously identified as *A. blitum* were instead *A. emarginatus*, while the actual occurrence of *A. blitum* s.s. was considered doubtful. Another underestimated taxon is *A. powellii* (often misidentified with *A. hybridus*), that was not indicated in any of the comprehensive Italian floras and that was recorded only recently by Conti *et al.* (2005) and Celesti-Grapow *et al.* (2010) in northern regions of Italy. Actually it occurs also in central and southern regions (Iamonico 2009b, Iamonico & Del Guacchio 2011, Iamonico *et al.* 2011b). Recurring errors in identification were also highligthed within the groups *A. albus*/*A. blitum*/*A. graecizans*/*A. viridis* (subgenus *Albersia*), *A. retroflexus*/*A. cruentus*/*A. hybridus*/*A. powellii* (subgenus *Amaranthus*), *A. tuberculatus*/*A. albus* (subgenus *Acnida* vs. subgenus *Albersia*), and *A. albus*/*A. blitum*/*A. cruentus*/*A. hybridus* (subgenus *Albersia* vs. subgenus *Amaranthus*).

Field surveys allowed to verify the degree of naturalization of all taxa, and, when necessary, to correct it (e.g., *A. deflexus* in Tuscany from naturalized to invasive, or *A. cruentus* in Lazio from invasive to naturalized). Threats are mainly observed in cultivated fields by loss of crop quality and efficiency (economical impact, see also Iamonico 2008e). In some cases, also ecological impacts were observed, both on the native riparian herbaceous vegetation (*A. tuberculatus* along the banks of the Po river) and by decreasing the floristic richness in urban ecosystems (e.g., *A. deflexus*, or *A. retroflexus*).

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TABLE 3. Occurrence of the *Amaranthus* taxa (accepted names listed in alphabetical order) in Italy (*A. crassipes* and the hybrids are not listed). Symbols and abbreviations for regional names follow Conti *et al.* (2005: 14–15): "+" occurring (native taxon), "-" recorded in the past by mistake, "?" doubtfully occurring, "0" not longer recorded. The abbreviations of the *status* of naturalization (alloctonous taxa) follow Celesti-Grapow *et al.* (2009b): CAS = casual, NAT = naturalized, INV = invasive. The empty cells indicate the absence of the taxon.

	VDA	PIE	LOM	TAA	VEN	FVG	LIG	EMR	TOS	MAR	UMB	LAZ	ABR	MOL	CAM	PUG	BAS	CAL	SIC	SAR
Amaranthus acutilobus															0			0		
Amaranthus albus	CAS	NAT	INV	NAT	CAS	NAT	CAS	NAT	NAT	NAT	NAT	INV	NAT	NAT	NAT	NAT	INV	INV	NAT	INV
Amaranthus blitoides	CAS	NAT	INV		CAS	NAT	CAS	NAT	CAS	NAT	CAS	INV	NAT	NAT	NAT	CAS	CAS	INV	NAT	NAT
Amaranthus blitum* subsp. *blitum* var. *blitum		NAT	+	+	NAT	+	+	+	+	+	NAT	+	+	+	+	+	+	+	+	+
Amaranthus blitum* subsp. *blitum* var. *oleraceus		CAS																		
Amaranthus bouchonii[1]		+	+	+	+	+	+	+	+											
Amaranthus cacciatoi												+								
Amaranthus caudatus		CAS	CAS	CAS	CAS	CAS	0	CAS	CAS	CAS	CAS	CAS	CAS		0	CAS			CAS	
Amaranthus crispus		CAS			CAS							CAS			-					INV
Amaranthus cruentus	-	NAT	-	CAS	NAT	CAS	CAS	NAT	INV	INV	NAT	NAT	NAT	NAT	NAT	CAS	NAT	CAS	NAT	INV
Amaranthus deflexus	NAT	INV	INV	NAT	NAT	NAT	NAT	NAT	INV	INV	INV	INV	INV	INV	INV	NAT	INV	INV	NAT	INV
Amaranthus emarginatus* subsp. *emarginatus* var. *emarginatus	CAS	CAS	CAS		CAS				0		CAS	CAS	0		CAS					CAS
Amaranthus emarginatus* subsp. *emarginatus* var. *pseudogracilis		CAS		NAT	CAS		CAS	NAT	CAS			CAS					CAS			
Amaranthus graecizans* subsp. *graecizans					?															
Amaranthus graecizans* subsp. *sylvestris		+	+	0	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Amaranthus hybridus	NAT	NAT	INV	NAT	NAT	NAT	CAS	NAT	CAS	NAT	NAT	INV	NAT	NAT	NAT	CAS	NAT	INV	NAT	INV
Amaranthus hypochondriacus		CAS	CAS		CAS	CAS		0	CAS	0	0	CAS	CAS		CAS		CAS		CAS	CAS
Amaranthus muricatus														NAT				NAT	NAT	INV
Amaranthus polygonoides			0	0						0		-	0	-	0	0				
Amaranthus palmeri								CAS												
Amaranthus powellii	NAT	CAS	INV	NAT	NAT	NAT		NAT				NAT	NAT		CAS					
Amaranthus retroflexus	NAT	INV	INV	INV	NAT	INV	NAT	NAT	NAT	INV	INV	INV	INV	INV	INV	INV	INV	INV	NAT	INV
Amaranthus spinosus					CAS	CAS	0	CAS				-								
Amaranthus tamariscinus						CAS														
Amaranthus tricolor					CAS	CAS									CAS					
Amaranthus tuberculatus		CAS	INV	CAS	NAT	CAS		INV	NAT	NAT										
Amaranthus viridis		-	NAT		NAT	CAS	CAS	0	CAS		CAS	INV			INV	NAT		INV	NAT	INV

[1] With the aim to highlight all the information, and since both Conti *et al.* (2005), and Celesti-Grapow *et al.* (2010) recognized *A. bouchonii* as an alien, the *status* of naturalization of this taxon at regional level follows: naturalized in PIE, LOM, TAA, FVG, LIG, and casual in VEN, EMR, and TOS (but see discussion under "Cholorogy" at page 64).

(Pavia), M. Broglio (Aosta), D. Carbini (Macerata), G. Faggi (Cesena), P. Ferrari (Modena), V. Lazzeri (Cagliari), A. Messina (Montemurlo, Prato), F. Neild (Maranola, Latina), L. Rignanese (Manfredonia, Foggia), F. Rossi (Termoli, Campobasso) kindly permitted the reproduction of their personal photographs. Figures 11B−C by A. Moro are reproduced under the licence Creative Commons Attribution Non Commercial Share-Alike 3.0 (CC by-nc–sa 3.0).

References

Acosta, J.M., Perreta, M., Amsler, A. & Vegetti, A.C. (2009) The Flowering Unit in the Synflorescence of Amaranthaceae. *Botanical Review* 75: 365–376. http://dx.doi.org/10.1007/s12229-009-9037-9

Acta Plantarum (2007) *IPFI, Indice dei nomi delle specie botaniche presenti in Italia*. Available from http://www.actaplantarum.org/flora/flora.php (accessed 6 March 2014).

Aellen, P.L. (1959) *Amaranthus* L. *In*: Hegi, G. (Ed.), *Illustrierte Flora von Mitteleuropa* 3(2). Carl Hanser Verlag, München, pp. 465–516.

Aellen, P.L. (1972) *Amaranthaceae*. L. *In:* Rechinger, K.H. (Ed.) *Flora Iranica* 91. Akad. Druck, Graz, pp. 1–19.

African Plant Database (2012) *Conservatoire et Jardin botaniques de la Ville de Genève and South African National Biodiversity Institute*. Available from http://www.ville-ge.ch/musinfo/bd/cjb/africa/ (accessed 6 March 2014).

Akeroyd, J.R. (1993). *Amaranthus* L. *In*: Tutin, T.G., Burges, N.A., Chater, A.O, Edmondson, J.R., Heywood, V.H., Moore, D.M., Valentine, D.H., Walters, S.M. & Webb, D.A. (Eds.) *Flora Europaea* 1. ed. 2. Cambridge University Press, Cambridge, pp. 130–132.

Al-Turki, T.A., Fifilan, S.A. & Mehmood, S.F. (2000) A cytological study of flowering plants from Saudi Arabia. *Willdenowia* 30: 339–358. http://dx.doi.org/10.3372/wi.30.30211

Alessandrini, A. (2010) *Flora del Modenese: censimento, analisi, tutela*. Coop. Dell'Olmo, Montecchio Emilia, 293 pp.

Anzalone, B. (1956) L'*Amarantus blitoides* Wats. in Italia e in Asia. *Annali di Botanica* 25: 22–30.

Anzalone, B., Iberite, M. & Lattanzi, E. (2010) La flora del Lazio. *Informatore Botanico Italiano* 42: 187–317.

Arcangeli, G. (1882) *Compendio della flora italiana*. Ermanno Loescher, Torino, 889 pp.

Arcangeli, G. (1884) *Flora italiana.* ed. 2. Tipografia Vincenzo Bona, Torino, 836 pp.

Ardenghi, N.M.G & Parolo, G. (2010) Primo contributo alla flora esotica della provincia di Sondrio (Lombardia, Italia). *Atti del Museo Civico di Storia Naturale di Morbegno* 21: 49–81.

Ardenghi, N.M.G & Rossi G. (2012) Notulae alla flora esotica d'Italia, 6: 157. *Informatore Botanico Italiano* 44: 402.

Ardenghi, N.M.G., Parolo, G. & Di Gregorio, B. (2011) Notulae alla flora esotica d'Italia, 4: 58. *Informatore Botanico Italiano* 43: 145.

Arrigoni, P.V. & Viegi, L. (2011) *La flora vascolare esotica spontaneizzata della Toscana*. Centro Stampa Giunta Regionale Toscana, Firenze, 217 pp.

Bacchetta, G., Mayoral Garcia Berlanga, O. & Podda, L. (2009) Catálogo de la Flora exótica de la isla de Cerdeña (Italia). *Flora Montiberica* 41: 35–61.

Balbis, G.B. (1804) *Miscellanea Botanica*. Torino, 68 pp.

Baquar, S.R. & Olusi, O.O. (1988) Cytomorphological and phylogenetic studies of the genus *Amaranthus* from Nigeria. *Kromosomo* 51–52: 1665–1674.

Bauhin, J. & Cherler J.H. (1651) *Historia Plantarum Universalis* 2. Fr. Lud. Graffenried, Ebroduni, 1074 pp.

Beck, G. (1909) *Icones Florae Germanicae et Helveticae* 24. F. Hofmeister, Lipsiae, 213 pp.

Bedini, G., Garbari, F. & Peruzzi, L. (2010) *Chrobase.it. Chromosome numbers for the Italian flora*. Available from: http//www.biologia.unipi.it/chrobase (accessed 10 July 2014).

Bedini, G., Garbari, F. & Peruzzi, L. (2012) Karyological knowledge of the Italian vascular flora as inferred by the analysis of "Chrobase.it". *Plant Biosystems* 146: 889–899.

Bertolli, A. & Prosser, F. (2014) SEGNALAZIONI FLORISTICHE TRIDENTINE. IX. *Annali del Museo Civico di Rovereto* 29(2013): 121–174

Bertoloni, A. (1854) *Flora italica, sistens plantas in Italia et in insulis circumstandibus sponte nascentes* 10. Ex Typographaeo Haeredum Richardi Masii, Bologna, 640 pp.

Bojian, B., Clemants, S.E. & Borsch, T. (2003) *Amaranthus* L. *In*: Wu, Z.Y., Raven, P.H. & Hong, D.Y. (Eds.) *Flora of China* 5. Science Press, Beijing and Missouri Botanical Garden Press, St. Louis, pp. 415–429.

Bolòs, O. de & Vigo, J. (1974) Notes sobre taxonomía i nomenclatura de plantes, I. *Butletí de la Institució Catalana D'Historia Natural Barcelona, Sección De Botánica* 38: 61–89.

Boulos, L. (1999) *Flora of Egypt* 1. Al Harara, Cairo, 419 pp.

Bracchi, G. & Romani, E. (2010) *Checklist aggiornata e commentata della flora vascolare della Provincia di Piacenza*. Museo Civico di Storia Naturale di Piacenza, Piacenza, 395 pp.

Britton, N. & Brown, A. (1913) *An Illustrated Flora Of The Northern United States, Canada And The British Possessions*.

Charles Scribner's sons, New York, 735 pp.
Brenan, J.P.M. (1961) *Amaranthus* in Britain. *Watsonia* 4: 261–280.
Cacciato, A. (1966) Il genere *Amaranthus* a Roma e nel Lazio. *Annali di Botanica* 28: 613–630.
Cacciato, A. (1967) Su due nuovi ibridi di Amaranto nei pressi di Roma. *Giornale Botanico Italiano* 101: 404–405.
Cacciato, A. (1969) Ancora sopra alcune piante avventizie della flora italiana. *Informatore Botanico Italiano* 1: 112–113.
Carrega, M. & Silla, D. (1995) Ricerche floritiche nel Novese e nel Tortonese (Provincia di Alessandria, Piemonte sud orientale). *Rivista Piemontese di Storia Naturale* 16: 17–76.
Carretero, J.L. (1984) Chromosome Number Reports LXXXIV. *Taxon* 33: 536–539.
Carretero J.L. (1990) *Amaranthus* L. *In*: Castroviejo, S., Laínz, M., López Gonzáles, G., Montserrat, P., Muñoz Garmendia, F., Paiva, J. & Villar, L. (Eds.) *Flora Iberica* 2. Real Jardín Botánico, CSIC, Madrid, pp. 559–569.
Caruel, T. (1893) *Flora italiana, ossia descrizione delle piante che crescono spontanee o vegetano come tali in Italia e nelle isole ad essa aggiacenti, disposte secondo il metodo naturale* 10. Tipografico Fiorentino, Firenze, 234 pp.
Celesti-Grapow, L., Alessandrini, A., Arrigoni, P.V., Banfi, E., Bernardo, L., Bovio, M., Brundu, G., Cagiotti, M.R., Camarda, I., Carli, E., Conti, F., Fascetti, S., Galasso, G., Gubellini, L., La Valva, V., Lucchese, F., Marchiori, S., Mazzola, P., Peccenini, S., Poldini, L., Pretto, F., Prosser, F., Siniscalco, C., Villani, M.C., Viegi, L., Wilhalm, T. & Blasi, C. (Eds.) (2009a) Inventory of the non-native flora of Italy. *Plant Biosystems* 143: 386–430.
http://dx.doi.org/10.1080/11263500902722824
Celesti-Grapow, L., Pretto, F., Carli, E. & Blasi, C. (Eds.) (2009b) *Non-native flora of Italy. Plant invasion in Italy – an overview*. Palombi & Partner, Roma, CD-ROM.
Celesti-Grapow, L., Pretto, F., Carli, E. & Blasi, C. (Eds.) (2010) *Flora vascolare alloctona e invasiva delle regioni d'Italia*. Casa Editrice Università La Sapienza, Roma, 208 pp.
Cesati, V., Passerini, G. & Gibelli, G. (1884) *Compendio della Flora italiana*. Vallardi, Milano, 906 pp.
Clark, G.H. & Fletcher, J. (1904) *Farm weeds of Canada*. Hon Sindey A. Fisher, Minister of Agricolture, Ottawa, 103 pp.
Conti, F. & Tinti, D. (2008) *Il lago di Campotosto e la sua flora*. Brandolini, Chieti, 160 pp.
Conti, F., Abbate, G., Alessandrini, A. & Blasi, C. (Eds.) (2005) *An annotated checklist of the Italian vascular flora*. Palombi & Partner, Roma, 420 pp.
Conti, F., Alessandrini, A., Bacchetta, G., Banfi, E., Barberis, G., Bartolucci, F., Bernardo, L., Bonacquisti, S., Bouvet, D., Bovio, M., Brusa, G., Del Guacchio, E., Foggi, B., Frattini, S., Galasso, G., Gallo, L., Gangale, C., Gottschlich, G., Grünanger, P., Gubellini, L., Iiriti, G., Lucarini, D., Marchetti, D., Moraldo, B., Peruzzi, L., Poldini, L., Prosser, F., Raffaelli, M., Santangelo, A., Scassellati, E., Scortegagna, S., Selvi, F., Soldano, A., Tinti, D., Ubaldi, D., Uzunov, D. & Vidali, M. (2007) Integrazioni alla checklist della flora vascolare italiana. *Natura Vicentina* 10(2006): 5–74.
Contré, E. (1947) Un nouvel hybride d'*Amaranthus*: × *Amaranthus* Rallentii E. Contré (*A. retroflexus* L. × *A. Bouchonii* Thell.). *Les Feuille des Naturalistes* 2: 11.
Coons, M.P. (1978) The status of *Amaranthus hybridus* L. in South America. The taxonomic problem. *Ciencia Naturaleza* 19: 66–71
Costea, M. (1998) *Monograph of the genus Amaranthus L. in Romania*. Ph.D. diss. University of Bucharest, College of Biology, Bucharest, 210 pp.
Costea, M. (2003) The identity of a cultivated *Amaranthus* from Asia and a new nomenclature combination. *Economic Botany* 57: 646–649.
http://dx.doi.org/10.1663/0013-0001(2003)057[0646:NOEP]2.0.CO;2
Costea, M., & Tardif, F.J. (2003a) The bracteoles in *Amaranthus* (Amaranthaceae): their morphology, structure, function and taxonomic significance. *Sida* 20: 969–985.
Costea, M. & Tardif, F.J. (2003b) Conspectus and notes on the genus *Amaranthus* (Amaranthaceae) in Canada. *Rhodora* 105: 260–281.
Costea, M. & Tardif, F.J. (2003c) The biology of Canadian weeds. 126. *Amaranthus albus* L., *A. blitoides* S.Watson and *A. blitum* L.. *Canadian Journal of Plant Science* 83: 1039–1066.
http://dx.doi.org/10.4141/P02-056
Costea, M., Sanders, A. & Waines, G. (2001a) Preliminary results towards a revision of the *Amaranthus hybridus* complex (Amaranthaceae). *Sida* 19: 931–974.
Costea, M., Sanders, A. & Waines, G. (2001b) Notes on some little known *Amaranthus* taxa (Amaranthaceae) in the United States. *Sida* 19: 975–992.
Costea, M., Weaver, S.E. & Tardif, F.J. (2003) The biology of Canadian weeds. 126. *Amaranthus retroflexus* L., *A. powellii* S.Watson and *A. hybridus* L. *Canadian Journal of Plant Science* 84: 631–668.
http://dx.doi.org/10.4141/P02-183
Costea, M., Weaver, S.E. & Tardif, F.J. (2005) The Biology of Invasive Alien Plants in Canada. 3. *Amaranthus tuberculatus* (Moq.) Sauer var. *rudis* (Sauer) Costea & Tardif. *Canadian Journal of Plant Science* 85: 507–522.
http://dx.doi.org/10.4141/P04-101
Costea, M., Brenner, D.M., Tardif, F.J., Tan, Y.F. & Sun, M. (2006) Delimitation of *Amaranthus cruentus* L. and *Amaranthus caudatus* L. using micromorphology and AFLP analysis: an application in germplasm identification. *Genetic Resources and Crop Evolution* 53: 1625–1633.
http://dx.doi.org/10.1007/s10722-005-2288-3

Covas, G. (1941) Las Amarantáceas bonarienses. *Darwiniana* 5: 329–368.
Del Guacchio, E. (2010) Appunti di floristica campana: novità e precisazioni. *Informatore Botanico Italiano* 42: 35–46.
Desfontaines, R.L. (1804) *Tableau de l'école de Botanique du Muséum d'Histoire Naturelle*. J.A. Brosson, Paris, pp. 238. http://dx.doi.org/10.5962/bhl.title.13828
Dmitrieva, S.A. (1986) Chromosome numbers in some species of vascular plants from Byelorussia. *Botanical Zhurnal SSSR* 71: 1145–1147.
Dobea, C. & Hahn B. (1997) IOPB chromosome data 11. *International Organization of Plant Biosystematists (Oslo)* 26/27: 15–18.
Dodonaei, R. (1616) *Stirpium Historiae pemptades sex, sive libri XXX*. Ex Officina Plantiniana, Antuerpiae, pp. 872.
Egea, J. de, Peña-Chocarro, M., Espada, C. & Knapp, S. (2011) Cheklist of vascular plants of the Department of Ñeembucú, Paraguay. *Phytokeys* 9: 15–179. http://dx.doi.org/10.3897/phytokeys.9.2279
El Hadidi, M.N. & El Hadidy, A.M. (1981) Amaranthaceae. *In*: El Hadidi, M.N. (Ed.) *Flora of Egypt*. Taeckholmia Additional Series 1: 13–92.
Fanelli, G., D'Angelis, D., De Sanctis, M. & Serafini Sauli, A. (2011) Notule floristiche per il Lazio. *Informatore Botanico Italiano* 43: 171–172.
Fawcett, W. & Rendle, A.B. (1914) *Flora of Jamaica containing descriptions of the flowering plants known from the island* 3. Order of the Trustees of the British Museum, London, 208 pp.
Fennane, M. & Tatou, M. (2005) Flore Vasculaire du Maroc. Inventaire et chorologie. *Travaux de l'Institut Scientifique, Université Mohammed V. Série Botanique* 37: 1–483.
Fernald, M.L. (1945) Botanical specialities of the Seward Forest and adjacent Areas of Southeastern Virginia. *Rhodora* 47: 139.
Fernandes, R. (1957) Nota sobre a flora de Portugal, VIII. [Sér. 2] *Boletim da Sociedade Broteriana* 31: 183–240.
Filias, F., Gaulliez, R. & Guedes, M. (1980) *Amaranthus blitum* vs. *A. lividus* (Amaranthaceae). *Taxon* 29: 149–150.
Fiori, A. (1923) *Nuova Flora Analitica d'Italia* 1. Ed. M. Ricci, Firenze, pp. 944.
Fiori, A. & Paoletti, G. (1898) *Flora Analitica Italia* 1. Tipografia del Seminario, Padova, 944 pp.
Gaines, T.A., Ward, S.M., Bukun, B., Preston, C., Leach, J.,E. & Westra, P. (2012) Interspecific hybridization transfers a previously unknown glyphosate resistance mechanism in *Amaranthus* species. *Evolutionary Applications* 5: 29–38. http://dx.doi.org/10.1111/j.1752-4571.2011.00204.x
Gallo, L. (2012) Flora esotica delle Colline del Po (Piemonte, Italia nord-occidentale): statistiche e catalogo delle entità. *I Quaderni di Muscandia* 112: 45–78.
Ghafoor, A., Jafri, S.M.H. & El-Gadi, A. (1977) Amaranthaceae. *In*: Jafri, S.M.H. & El-Gadi, A. (Eds.) *Flora of Libya* 42. Al Faateh University, Tripoli, pp. 1–25.
Grant, F.W. (1959) Cytogenetic studies in *Amaranthus* III. Chromosome numbers and phylogenetic aspects. *Canadian Journal of Genetics and Cytology* 1: 313–318. http://dx.doi.org/10.1139/g59-031
Green, M.L. (1929) *Amaranthus caudatus* L. *In*: Hitchcock, A.S. (Ed.) *Nomenclature. Proposals by British Botanists*. Wyman & Sons, London, 188 pp.
Greizerstein, E. & Poggio, L. (1992) Estudios citogenéticos en seis híbridos del género *Amaranthus*. *Darwiniana* 31: 159–165.
Greizerstein, E. & Poggio, L. (1994) Karyological studies in grain amaranths. *Cytologia* 59: 25–30. http://dx.doi.org/10.1508/cytologia.59.25
Greizerstein, E., Naranjo C.A. & Poggio, L. (1997) Karyological studies in five wild species of amaranths. *Cytologia* 62: 115–120. http://dx.doi.org/10.1508/cytologia.62.115
Greuter, W., Burdet, H.M. & Long, G. (1984) *Med-Checklist. A critical inventory of vascular plants of the circum-mediterranean countries.* Conservatoire et Jardin Botaniques de la Ville de Genève, Genève, pp. 330.
Heiser, C.B. & Whitaker, T.W. (1948) Chromosome number, polyploidy and growth habit in California weeds. *American Journal of Botany* 35: 179–186. http://dx.doi.org/10.2307/2438241
Hendrickson, J. (1999) Studies in new world *Amaranthus*. *Sida* 18: 783–807.
Hicken, C.M. (1910) Chloris Platensis Argentina. *Apuntes de Historia Natural Buenos Aires* 2: 1–292.
Hindáková, M. (1978) Index of chromosome numbers of Slovakian flora. Part 6. *Acta Facultatis Rerum Naturalium Universitatis Comenianae Zoologia* 26: 1–42.
Hindáková, M. & Schwarzova, T. (1978) IOPB chromosome number reports LXI. *Taxon* 27: 375–392.
Hindáková, M. & Schwarzova, T. (1980) IOPB chromosome number reports LXIX. *Taxon* 29: 79–81.
Hindáková, M. & Schwarzova, T. (1987) Karyological study of the Slovak flora XX. *Acta Facultatis Rerum Naturalium Universitatis Comenianae Zoologia* 34: 21–25.
Hügin, G. (1987) Einige Bemerkungen zu wenig bekannten *Amaranthus*-Sippen (Amaranthaceae) Mitteleuropas. *Willdenowia* 16: 453–478.
Iamonico, D. (2008a) Sulla presenza di alcune entità del genere *Amaranthus* L. (Amaranthaceae) nel Lazio. *Informatore Botanico Italiano* 40: 23–26.
Iamonico, D. (2008b) Osservazioni sulla variabilità morfologica di *Amaranthus retroflexus* L. (Amaranthaceae) in Italia

centrale. *Lagascalia* 28: 425–435.
Iamonico, D. (2008c) Notulae alla checklist della flora vascolare italiana, 5: 1459. *Informatore Botanico Italiano* 40: 110.
Iamonico, D. (2008d) Notulae alla checklist della flora vascolare italiana, 6: 1522–1523. *Informatore Botanico Italiano* 40: 263.
Iamonico, D. (2008e) Invasività e problematiche tassonomiche relative al genere *Amaranthus* L. in Italia. *In*: Galasso, G., Chiozzi, G., Azuma, M. & Banfi, E. (Eds.) Le specie alloctone in Italia: censimenti, invasività e piani d'azione. *Memorie della Societa Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano* 36: 68.
Iamonico, D. (2009a) Il genere *Amaranthus* L. in Italia: stato attuale delle conoscenze. *Annali di Botanica (Roma), Quaderni n.s.*
Iamonico, D. (2009b) First record of *Amaranthus powellii* subsp. *powellii* (Amaranthaceae) in Lazio region (central Italy) with taxonomical, morphological, chorological and ecological notes. *Acta Botanica Malacitana* 34: 221–226.
Iamonico, D. (2009c) Il genere *Amaranthus* (Amaranthaceae) negli erbari pugliesi di Bari (BI) e Lecce (LEC). *Thalassia Salentina* 32: 139–144.
Iamonico, D. (2009d) Invasive status and presence of *Amaranthus polygonoides* L. (Amaranthaceae) in Italy, with notes on its taxonomy and morphology. *Flora Mediterranea* 19: 233–239.
Iamonico, D. (2009e) Note ecologiche su *Amaranthus blitoides* S.Watson (Amaranthaceae) e suoi caratteri d'invasività. *Lagascalia* 29: 29–41.
Iamonico, D. (2009f) Contributo alla conoscenza del genere *Amaranthus* L. (Amaranthaceae) nel Lazio. Proposta per una chiave analitica. *Informatore Botanico Italiano* 41: 25–28.
Iamonico, D. (2009g) Chiave analitica delle specie del genere *Amaranthus* L. (Amaranthaceae) presenti in Valle d'Aosta. *Revue Valdôtaine d'Histoire Naturelle* 63: 63–68.
Iamonico, D. (2009h) Osservazioni morfologiche e distributive su *Amaranthus blitoides* S.Watson (Amaranthaceae), esotica nuova per la flora della Puglia. *Annali del Museo Civico di Rovereto* 24(2008): 171–176.
Iamonico, D. (2009i) Aggiornamenti floristici per il genere *Amaranthus* L. (Amaranthaceae) in Italia. *Informatore Botanico Italiano* 41: 303–306.
Iamonico, D. (2010a) On the presence of *Amaranthus polygonoides* L. (Amaranthaceae) in Europe. *Phyton (Horn, Austria)* 50: 205–219.
Iamonico, D. (2010b) Biology, life-strategy and invasiveness of *Amaranthus retroflexus* L. (Amaranthaceae) in central Italy: preliminary remarks. *Botanica Serbica* 34: 137–145.
Iamonico, D. (2010c) *Amaranthus tamariscinus* Nutt. (Amaranthaceae): taxonomical notes on the species and its presence in Italy. *Natura Sloveniae* 12: 25–33.
Iamonico, D. (2010d) Aggiornamenti floristici per il genere *Amaranthus* L. (Amaranthaceae) in Italia. 2. *Informatore Botanico Italiano* 42: 499–502.
Iamonico, D. (2011) *Amaranthus tuberculatus* (Moq.) J.D.Sauer in provincia di Belluno (Italia nord-orientale). *Frammenti* 3: 19–24.
Iamonico, D. (2012a) *Amaranthus powellii* S.Watson subsp. *cacciatoi* comb. & stat. nov. (Amaranthaceae). *Nordic Journal of Botany* 30: 12–16.
http://dx.doi.org/10.1111/j.1756-1051.2011.01080.x
Iamonico, D. (2012b) Aggiornamenti floristici per il genere *Amaranthus* L. (Amaranthaceae) in Italia. 3. *Informatore Botanico Italiano* 44: 159–162.
Iamonico, D. (2012c) Distribuzione del genere *Amaranthus* L. (Amaranthaceae) in Italia. 1. Provincia di Belluno (Italia nord-orientale). *Frammenti* 4: 95–106.
Iamonico, D. (2012d) Aggiornamenti floristici per il genere *Amaranthus* L. (Amaranthaceae) in Italia. 4. [Serie B] *Atti della Società Toscana di Scienze Naturali, Memorie* 119(2012): 19–21.
Iamonico, D. (2013a) Notulae alla flora esotica d'Italia, 9: 196. *Informatore Botanico Italiano* 45: 310.
Iamonico, D. (2013b) Notulae alla flora esotica d'Italia, 9: 198. *Informatore Botanico Italiano* 45: 310.
Iamonico, D. (2013c) Notulae alla flora esotica d'Italia, 9: 197. *Informatore Botanico Italiano* 45: 310.
Iamonico, D. (2013d) *Amaranthus cacciatoi* (Aellen ex Cacciato) Iamonico, comb. nov. *In*: Greuter, W. & Raus, T. (Eds.) Med-Cheklist notulae 2. *Willdenowia* 43: 239–240.
Iamonico, D. (2014a) Lectotypification of Linnaean names in the genus *Amaranthus* L. (Amaranthaceae). *Taxon* 63: 146–150.
http://dx.doi.org/10.12705/631.34
Iamonico, D. (2014b) *Amaranthus gangeticus* (Amaranthaceae), a name *incertae sedis*. *Phytotaxa* 162: 299–300.
http://dx.doi.org/10.11646/phytotaxa.162.5.2
Iamonico, D. (2014c) *Amaranthus graecizans s.l.* (*Amaranthacee*) in Italia: note tassonomiche e distributive. *Informatore Botanico Italiano* 46: 39–46.
Iamonico, D. (2014d) *Amaranthaceae* Juss. *In*: Bovio, M. (Ed.) *Flora vascolare della Valle D'Aosta. Repertorio commento e stato delle conoscenze*. Testolin, Sarre (AO), 396–404 pp.
Iamonico, D. (2014e) Notulae alla flora esotica d'Italia, 10: 235. *Informatore Botanico Italiano*.
Iamonico, D. (2015) Nomenclature survey of the genus *Amaranthus* (Amaranthaceae). 3. Names linked to the Italian flora. *Plant Biosystems*.
http://dx.doi.org/10.1080/11263504.2014.987188

Iamonico, D. & Antonietti, A. (2015) *Amaranthus caudatus* L. *A. hypochondriacus* L. *In*: Selvaggi, A., Soldano, A., Pascale, M. & Dellavedova, R. (Eds.) Note floristiche piemontesi. *Rivista Piemontese di Storia Naturale*.
Iamonico, D. & Ardenghi, N.M.G. (2013) Noterella 0090. *Amaranthus powellii* S.Watson subsp. *bouchonii*. *Acta Plantarum Notes* 2: 118–119.
Iamonico, D. & Bovio, M. (2010) Nuove acquisizioni per il genere *Amaranthus* L. (Amaranthaceae) in Valle d'Aosta (Italia settentrionale). *Revue Valdôtaine d'Histoire Naturelle* 64: 55–60.
Iamonico, D. & Bovio, M. (2013) Distribuzione del genere *Amaranthus* L. (Amaranthaceae) in Italia. 2. Valle d'Aosta. *Revue Valdôtaine d'Histoire Naturelle* 67: 41–54.
Iamonico, D. & Calvia, G. (2011) Notulae alla flora esotica d'Italia, 5: 102. *Informatore Botanico Italiano* 43: 375.
Iamonico, D. & Das, S. (2014) *Amaranthus bengalense* (Amaranthaceae) a new species from India, with taxonomical notes on *A. blitum* aggregate. *Phytotaxa* 181: 293−300.
http://dx.doi.org/10.11646/phytotaxa.181.5.4
Iamonico, D. & Del Guacchio, E. (2011) *Amaranthus powellii* S. Watson subsp. *powellii* (Amaranthaceae), nuova per la flora esotica della Campania. *Delpinoa* 49(2007): 71–75.
Iamonico, D. & Ferretti, G. (2011) Notulae alla flora esotica d'Italia, 5: 96. *Informatore Botanico Italiano* 43: 374.
Iamonico, D. & Forbicioni, L. (2011) Segnalazione 91. *In:* Peruzzi L., Vicini D., Bedini G. (Eds.) Contributi per una Flora Vascolare di Toscana. II (86−142). [Serie B] *Atti della Società Toscana di Scienze Naturali, Memorie* 117(2010): 24.
Iamonico, D. & Iberite, M. (2012) Amaranthaceae and Chenopodiaceae in Italy: current understanding and future prospective. *In*: Timonin, A.K., Sukhorukov, A.P., Harper, G.H. & Nilova, M.V. (Eds.) *Proceedings of the Symposium "Caryophyllales": New insights into the Phylogeny, Systematics and Morphological Evolution of the Order*. M.V. Lomonosov State University, Moscow, 24–27 September 2012, pp. 65−69.
Iamonico, D. & Rignanese, L. (2013) Notulae alla flora esotica d'Italia, 9: 199. *Informatore Botanico Italiano* 45: 310.
Iamonico, D. & Sánchez Del Pino, I. (2012) *Amaranthus blitum* L. subsp. *oleraceus* (L.) Costea. *In*: Greuter, W. & Raus, T. (Eds.) Med-Checklist Notulae 31. *Willdenowia* 42: 288.
Iamonico, D. & Wilhalm, T. (2008) Notulae alla checklist della flora vascolare italiana, 5: 1464. *Informatore Botanico Italiano* 40: 111.
Iamonico, D., Tisi, A., Barni, E. & Siniscalco, C. (2010) Tre nuove entità del genere *Amaranthus* L. (Amaranthaceae) in Piemonte (Italia settentrionale). *Rivista Piemontese di Storia Naturale* 31: 63–72.
Iamonico, D., Messina, A. & Acciai, B. (2011a) Segnalazione 92. *In*: Peruzzi, L., Viciani, D. & Bedini G. (Eds.) Contributi per una Flora Vascolare di Toscana. II (86−142). [Serie B] *Atti della Società Toscana di Scienze Naturali, Memorie* 117(2010): 24.
Iamonico, D., Bartolucci, F. & Conti, F. (2011b) Notulae alla flora esotica d'Italia, 5: 93. *Informatore Botanico Italiano* 43: 373.
Iamonico, D., Iberite, M. & Lattanzi, E. (2012) Aggiornamento della flora esotica del Lazio (Italia centrale). I. *Informatore Botanico Italiano* 42: 347−354.
Iamonico, D., Lazzeri, V., Mazzoncini, V. & Sammartino, F. (2013) Noterella 0135. *Amaranthus blitum* L. subsp. *emarginatus* (Moq. ex Uline & W.L. Bray) Carretero, Muñoz Garm. & Pedrol. *Acta Plantarum Notes* 2: 164.
Iamonico, D., Ardenghi, N.G.M. & Faggi, G. (2015) *Amaranthus palmeri* S.Watson *In*: Raab-Straube, E. von & Raus, T. (Eds.) Med-Cheklist notulae 4. *Willdenowia.*
IPNI (2008) *The International Plant Names Index*. Available from http://www.ipni.org (accessed 28 October 2014).
Jacquin, N.J. (1789a) *Collectanea ad Botanicam, Chemian et Historiam Naturalem, spectantia* 2. Ex Officina Wappleriana, Vindobonae, 374 pp. + 18 plates.
Jacquin, N.J. (1789b) *Icones Plantarum Rariorum* 2. Christianum Fridericum Wappler, B. White et Filium and S. et J. Luchtmans, Vindobonae, Londini and Lugduni Batavorum, 22 pp. + 253 plates.
Jonsell, B. (Ed.) (2001) *Flora Nordica. Chenopodiaceae to Fumariaceae* 2. Swedish Royal Academy of Sciences, Stockholm, 430 pp.
Jørgensen, P.M. & Ulloa Ulloa, C. (1994) *Seed plants of the high Andes of Equador - A Checklist*. AAU Rep., 443 pp.
Kiehn, M., Vitek, E., Hellmayr, E., Walter, J., Tschennet, J., Justin, C. & Mann, M. (1991) Beiträge zur Flora von Österreich: weitere Chromosomen- zählungen. *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien* 128: 13–39.
Kerguélen, M. (1993) *Index synonymique de la flore de France*. Available from: www2.dijon.inra.fr/bga/fdf/am.htm (accessed 6 March 2014).
Kops, J. & Eden, F.W. van (1924) *Flora Batava: afbeelding en beschrijving van Nederlandsche gewassen* 26. Martinus Nijhoff, 's-Gravenhage, 537 pp.
Krahulcová, A. (1990) Selected chromosome counts of the Czechoslovak flora II. *Folia Geobotanica et Phytotaxonomica* 25: 381–388.
http://dx.doi.org/10.1007/BF02914008
Krasnikov, A.A. & Lomonosova, M.N. (1990) Chromosome numbers in representatives of some families of vascular plants in the flora of the Novosibirsk region. *Botanicheskii Zhurnal Moscow & Leningrad [St. Petersburg]* 75: 116–118.
Kunth, K.S. (1838) *Flora Berolinensis* 2. ed. 2. Vendunt Duncker et Humblot, Berlin, 438 pp.
La Rosa, M. & Peruzzi L. (2013) Notulae alla flora esotica d'Italia, 9: 188. *Informatore Botanico Italiano* 45: 309.
Le Floc'h, E., Boulos, L. & Vela, E. (2010) *Catalogue synonymique commenté de la Flore de Tunisie*. Ministère de

l'Environnement et du Développement Durable & Banque Nationale de Gènes, Tunis, 500 pp.
Lanta, V., Havránek, P. & Ondřej, V. (2003) Morphometry analysis and seed germination of *Amaranthus cruentus*, *A. retroflexus* and their hybrid (*A. × turicensis*). *Plant Soil Environment* 49: 364−369.
Lazzeri, V., Mascia, F., Sammartino, F., Campus, G., Caredda, A., Carlesi, V., Fois, M., Gestri, G., Mannocci, M., Mazzoncini, V., Lombraña, A.C. & Santinelli, M. (2013) Novità floristiche per le regioni Sardegna e Toscana. *Acta Plantarum Notes* 2: 42−59.
Linnaeus, C. (1753) *Species plantarum* 2. Laurentii Salvii, Holmiae, 899 pp.
Linnaeus, C. (1755) *Centuria I Plantarum*. Reg. Acad. Typogr., Stockholmiae, 36 pp.
Linnaeus, C. (1759a) *Plantarum Jamaicensium Pugillus*. G. Elmgren, Upsaliae, 32 pp.
Linnaeus, C. (1759b) *Systema Naturae* 2. [ed. 10] Laurentii Salvii, Stockholm, 559 pp.
Linnaeus, C. (1763) *Species plantarum* 2. [ed. 2] Laurentii Salvii, Stockholm, 899 pp.
Linnaeus, C. (1771) *Mantissa Plantarum Altera*. Holmiae: Laurentii Salvii, 584 pp.
Lorenzoni, G.G. & Ziliotto, U. (1967) Il genere *Amaranthus* dell'Erbario veneto dell'Istituto botanico dell'Università di Padova. *Giornale Botanico Italiano* 72(1965): 605–613.
Madhusoodanan, K.J. & Nazeer, M.A. (1983) Comparative morphology of the somatic karyotypes of vegetable amaranths and its phylogenetic significance. *Cytologia* 48: 237–244.
http://dx.doi.org/10.1508/cytologia.48.237
Madhusoodanan, K.J. & Pal, M. (1981) Cytology of vegetable amaranths. *Botanical Journal of Linnean Society* 82: 61–68.
http://dx.doi.org/10.1111/j.1095-8339.1981.tb00950.x
Madhusoodanan, K.J. & Pal, M. (1983) Colchitetraploids in *Amaranthus tricolor* Linn. *New Botanist* 10: 17–23.
Masin, R. & Scortegagna, S. (2012) Flora alloctona del Veneto centro-meridionale (province di Padova, Rovigo, Venezia e Vicenza - Veneto - NE Italia). *Natura Vicentina* 15(2011): 15–54.
Maundu, P.M. & Grubben, G.J.H. (2004) *Amaranthus graecizans* L. Available from http://database.prota.org/PROTAhtml/Photfile%20Images%5CLinedrawing%20Amaranthus%20graecizans.gif (accessed 28 October 2014).
McNeill, J., Barrie, F.R., Buck, W.R., Demoulin, V., Greuter, D.L., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Marhold, K., Prado, J., Proud'Homme van Reine, W.F., Smith, J.F. & Wiersema, J.H. (Eds.) (2012) *International Code of Nomenclature for algae, fungi and plants (Melbourne Code): Adopted by the Eighteenth International Botanical Congress, Melbourne, Australia, July 2011. Regnum Vegetabile* 154. Ruggell, 274 pp.
Melzer, H. & Bregant, E. (1990) Neues zur Flora von Friaul-Julisch Venetien, Slowenien und Kroatien. *Gortania* 11(1989): 161–176.
Mosyakin, S.L. & Robertson, K.R. (1996) New infrageneric taxa and combinations 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 (Eds.) *Flora of North America North of Mexico (Magnoliophyta: Caryophyllidae, part 1)* 4. Oxford University Press, Oxford, pp. 410–435.
Mulligan, G.A. (1984) Chromosome numbers of some plants native and naturalized in Canada. *Naturaliste Canadien* 111: 447–449.
Murray, M.J. (1940) The genetics of sex determination in the family Amaranthaceae. *Genetics* 25: 409–431.
Paiva, J. & Leitao, M-T. (1989) Números cromosómicos para alguns taxa da Africa tropical II. [Sér. 2] *Boletim de Sociedade Broteriana* 62: 117–130.
Pal, M. & Khoshoo, T.M. (1973) Evolution and improvements of cultivated Amaranths VI. Cytogenetic relationships in grain types. *Theoretical and Applied Genetics* 43: 242–251.
http://dx.doi.org/10.1007/BF00278171
Pal, M. & Pandey, R.M. (1989) Cytogenetics and evolution of grain amaranths. *Aspects of Plant Science* 11: 323–336
Pal, M., Pandley, R.M. & Khoshoo, T.M. (1982) Evolution and improvements of cultivated amaranths IX. Cytogenetic relationships between the two basic chromosome numbers. *Journal of Heredity* 73: 353–356.
Palmer, J. (2009) A conspectus of the genus *Amaranthus* L. (Amaranthaceae) in Australia. *Nuytsia* 19: 107–128.
Palomino, G. & Rubí, R. (1991) Diferencias cromosómicas entre algunas especies y tipos del género *Amaranthus* distribuidos en México. *Memorias del Primer Congreso Internacional del Amaranto (Oaxtepec, Morelos, México)*.
Pandley, R.M. (1999) Evolution and improvement of cultivated amaranths with reference to genome relationship among *A. cuentus*, *A. powellii* and *A. retroflexus*. *Genetic Resourced and Crop Evolution* 46: 219–224.
http://dx.doi.org/10.1023/A:1008664611893
Pignatti, S. (1982) *Flora d'Italia* 1. Edagricole, Bologna, 790 pp.
Pinto, W.M. & Velásquez, G.O. (2010) Sinopsis del subgénero Amaranthus (*Amaranthus*, Amaranthaceae) en Venezuela. *Acta Botanica Venezuelanica* 33: 329–356.
Pogan, E., Czapik, R., Jankun, A. & Kuta, E. (1982) Further studies into the chromosome numbers of Polish angiosperms. Part XV. *Acta Biologica Cracoviensia Series Botanica* 24: 113–126.
Poiret, J.L.M. (1810) *Encyclopédie Méthodique* 1(1). H. Agasse, Paris, 761 pp.
Pontecorvo, C. (2007) *La flora dell'Iglesiente (Sardegna SW)*. Università degli studi di Cagliari, 791 pp.
Pratt, D.B. & Clark, L.G. (2001) *Amaranthus rudis* and *A. tuberculatus* - one species or two? *The Journal of the Torrey Botanical Society* 128: 282–296.

http://dx.doi.org/10.2307/3088718
Pratt, D.B., Jhangiani, S.N., & Wiggers, R.J. (2008) 2C DNA content values in *Amaranthus* (Amaranthaceae). *Journal of the Botanical Research Institute of Texas* 2: 1219–1223.
Priszter, S. (1949) *Amaranthus*–viszgalatok. 1. *Amaranhtus*-hibridek Magyarorszagon. *Index Horti botanici Universitatis budapestinensis*, *Budapest* 7: 116–149.
Priszter, S. (1958) Über die bisher bekannten Bastarde der Gattung *Amaranthus*. *Bauhinia* 1: 126–135.
Probatova, N.S. (2000) Chromosome numbers in some plant species from the Razdolnaya (Suifun) river basin (Primorsky Territory). *Botaničeskij Žhurnal (Moscow & Leningrad)* 85(12): 102–107.
Pyšek, P., Richardson, D.M., Rejmánek, M., Webster, G.L., Williamson, M. & Kirschner, J. (2002) Alien plants in checklists and floras: towards better communication between taxonomists and ecologists. *Taxon* 53: 131–143.
http://dx.doi.org/10.2307/4135498
Pyšek, P., Sádlo, J. & Mandák, B. (2004) Catalogue of alien plants of the Czech Republic. *Preslia* 74: 97–186.
Queirós, M. (1989) Estudos citotaxonómicos em Amaranthus de Portugal. *Lazaroa* 11: 9–17.
Ramesh, B. & Kumar, P. (2009) Meiotic chromosome analysis in inter-specific F1 hybrids of grain amaranths. *Journal of Biological Sciences* 1: 105–112.
Raus, Th. (1997) *Amaranthus* L. *In*: Strid, A. & Tan, K. (Eds.) *Flora Hellenica* 1. Koeltz Scientific Books, Königstein, pp. 138–146.
Rayburn, A.R., McCloskey, R., Tatum, T.C., Bollero, G.A., Jeschke, M.R. & Tranel, P.J. (2005) Genome Size Analysis of Weedy *Amaranthus* Species. *Crop Science* 45: 2557–2562.
http://dx.doi.org/10.2135/cropsci2005.0163
Reveal, J.L. & Jarvis, C.E. (2009) Typification of names of temperate North American plants proposed by Linnaeus. *Taxon* 58: 977–984.
Reveal, J.L. & Spellenberg, R. (1976) Miscellaneous chromosome counts of Western American plants - III. *Rhodora* 78: 37–52.
Ricciardi, A. & Cohen, J. (2007) The invasiveness of an introduced species does not predict its impact. *Biological Invasions* 9: 309–315.
http://dx.doi.org/10.1007/s10530-006-9034-4
Richardson, D.M. & Pyšek, P. (2006) Plant invasions: merging the concepts of species invasiveness and community invasibility. *Progress in Physical Geography* 30: 409–431.
http://dx.doi.org/10.1191/0309133306pp490pr
Robertson, K.R. (1981) The genera of Amaranthaceae in the Southeastern United States. *Journal of the Arnold Arboretum* 62: 267–313.
Saccardo, P.A. (1909) *Cronologia della flora italiana*. Tipografia del Seminario, Padova, 390 pp.
Sauer, J.D. (1955) Revision of the dioecious amaranths. *Madroño* 13: 5–46.
Sauer, J.D. (1967) The grain amaranths and their relatives: a revised taxonomic and geographic survey. *Annals of the Missouri Botanical Garden* 54: 103–137.
http://dx.doi.org/10.2307/2394998
Sauer, J.D. (1972) The dioecious amaranths: a new species name and major range extensions. *Madroño* 21: 426–434.
Sennen, F. (1936) *Diagnoses des nouveautés parues dans les exsiccata. Plantes d'Espagne et du Maroc de 1928 à 1935*. Anglada, Melilla, 308 pp.
Sharma, A.K. (1970) Annual report, 1967-1968. *Annual Report of Cytogenetics Laboratory Department of Botany, University* of *Calcutta*. *Research Bulletin* 2: 1–50.
Sharma, A.K. & Banik, M. (1965) Cytological investigation of different genera of Amaranthaceae with a view to trace their interrelationships. *Bulletin of the botanical society* of *Bengal* 19: 40–50.
Sheidai, M. & Mohammadzdeh, Z. (2008) Cytogenetic study of *Amaranthus* L. species in Iran. *Cytologia* 73: 1–7.
http://dx.doi.org/10.1508/cytologia.73.1
Sloane, H. (1707) *A voyage to the Islands Madera, Barbados, Nieves, S. Christophers and Jamaica, with the Natural History of the Herbs and Trees, Four-footed Beasts, Fishes, Birds, Insects, Reptiles, &C. of the last of those Islands* 1. B.M., London, 264 pp.
Song, B.-H., Zhang, X.-J., Li, F.-Z. & Wan, P. (2002) Chromosome numbers of 14 species in *Amaranthus* from China. *Acta Phytotaxonomica Sinica* 40: 428–432.
Stinca, A. & Motti, R. (2013) Notulae alla flora esotica d'Italia, 15: 175. *Informatore Botanico Italiano* 45: 108.
Stinca, A., D'Auria, G., Salerno, G. & Motti, R. (2013) Ulteriori integrazioni alla flora vascolare aliena della Campania (Sud Italia). *Informatore Botanico Italiano* 45: 71–81.
Tandon, S.L. & Tawakley, M. (1970) IOPB chromosome number reports XXVI. *Taxon* 19: 264–269.
Thellung, A. (1914) *Amaranthus* L. *In*: Ascherson, P. & Graebner, P. (Eds.) *Synopsis der Mitteleuropäischen Flora* 5. Verlag Von Gebrüder Borntraeger, Leipzig, pp. 225–356.
Thiers, B. (2014) *Index herbariorum, a global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium*. Available from: http://sweetgum.nybg.org/ih/ (accessed 28 October 2014).
Trucco, F. & Tranel, P.J. (2011) *Amaranthus*. *In*: Kole, C. (Ed.) *Wild Crop Relatives: Genomic and Breeding Resources, Vegetables*. Springer, Berlin, pp. 11–21.

http://dx.doi.org/10.1007/978-3-642-20450-0_2
Trucco, F., Tatum, T., Robertson, K.R., Rayburn, A.L. & Tranel, P.J. (2006) Characterization of Waterhemp (*Amaranthus tuberculatus*) × Smooth Pigweed (*A. hybridus*) F1 Hybrids. *Weed Technology* 20: 14–22. http://dx.doi.org/10.1614/WT-05-018R.1
Townsend, C.C. (1974) Amaranthaceae. *In*: Nasir, E. & Ali, S.I. (Eds.) *Flora of West Pakistan* 71. Ferozsons Press, Rawalpindi, pp. 1–49.
Townsend, C.C. (1985) Amaranthaceae. *In*: Polhill, R.M. (Ed.) *Flora of Tropical East Africa*. A.A. Balkema, Rotterdam, pp. 1–136.
Townsend, C.C. (1994) Amaranthacées. *In*: Bosser, J., Cadet, T., Guého, J. & Marais, W. (Eds.) *Flore des Mascareignes: La Réunion, Maurice, Rodrigues* 142. Royal Botanic Gardens, Kew, pp. 1–32.
Ugborogho, R.E. & Oyelana, O.A. (1992) Meiosis, pollen morphology and perianth stomata of some taxa of *Amaranthus* (Amaranthaceae) in Nigeria. *Feddes Repertorium* 103: 363–373. http://dx.doi.org/10.1002/fedr.19921030514
Vitek, E., Kiehn, M., Pascher, K., Starlinger, F., Greimler, J., Stocker, U., Lehner, S., Beinhofer, P. & Blaha, A. (1992) Beiträge zur Flora von Österreich- weitere Chromosomezählungen. *Verhandlungen der Zoologisch-Botanischen Gesellschaft Österreich* 129: 215–226.
Walter, J. & Dobes, C. (2004) Morphological characters, geographic distribution and ecology of neophytic *Amaranthus blitum* L. subsp. *emarginatus* in Austria. *Annalen des Naturhistorischen Museums Wien* 105(B): 645–672.
Ward, D.E. (1984) Chromosome counts from New Mexico and Mexico. *Phytologia* 56: 55–60.
Wassom, J.J. & Tranel, P.J. (2005) Amplified Fragment Length Polymorphism-Based Genetic Relationships Among Weedy *Amaranthus* Species. *Journal of Heredity* 96: 410–416. http://dx.doi.org/10.1093/jhered/esi065
Weaver, S.E. & McWilliams, E.L. (1980) The biology of Canadian weeds. 44. *Amaranthus retroflexus* L., *A. powellii* S. Wats. and *A. hybridus* L. *Canadian Journal of Plant Science* 60: 1215–1234. http://dx.doi.org/10.4141/cjps80-175
Wilhalm, T., Zemmer, F., Beck, R., Stockner, W. & Tratter, W. (2004) Für die Flora Südtirol neue Gefäβpflanzen aus den Jahren 2002−2004. *Gredleriana* 4: 396.
Wilkin, P. (1992) The status of *Amaranthus bouchonii* Thellung within *Amaranthus* section *Amaranthus*: new evidence from study of morphology and isozyme. *Botanical Journal of Linnaean Society* 108: 253–267. http://dx.doi.org/10.1111/j.1095-8339.1992.tb00242.x
Willdenow, C.L. (1790) *Historia Amaranthorum*. Impensis Ziegleri et fil., Turici, 38 pp.
Xu, Y.B. (1987) Studies on the chromosome number of some species of *Amaranthus*. *Grassland of China* 3: 48–50.
Xu, F. & Sun, M. (2001) Comparative analysis of phylogenetic relationships of grain amaranths and their wild rlatives (*Amaranthus*; Amaranthaceae) using internal transcribed spacer, amplified fragment length polymorphism, and double-primer fluorescent intersimple sequence repeat markers. *Molecular Phylogenetics and Evolution* 21: 372–387. http://dx.doi.org/10.1006/mpev.2001.1016
Zangheri, P. (1976) *Flora Italica* 1. Ed.Cedam, Padova, 1157 pp.

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