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On the Presence of *Amaranthus polygonoides* L. (*Amaranthaceae*) in Europe

By

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With 2 Figures

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Summary

IAMONICO D. 2011. On the presence of *Amaranthus polygonoides* L. (*Amaranthaceae*) in Europe. – *Phyton* (Horn, Austria) 50 (2): 205–219, with 2 figures.

Based on a review of literature and on-line meta sources, examination of specimens in the main European Herbaria and floristic surveys, the distribution and the invasive status (ephemeral!) of *Amaranthus polygonoides* L. (*Amaranthaceae*) in Europe are discussed. Taxonomical notes and a detailed description and illustration of the species are also provided, as well as a key for four species of *A.* subg. *Albresia* sect. *Pentamoron*.

Zusammenfassung

IAMONICO D. 2011. On the presence of *Amaranthus polygonoides* L. (*Amaranthaceae*) in Europe. [Über die Vorkommen von *Amaranthus polygonoides* L. (*Amaranthaceae*) in Europa]. – *Phyton* (Horn, Austria) 50 (2): 205–219, mit 2 Abbildungen.

Aufgrund der Durchsicht von Literatur, Online-Quellen, Überprüfung von Herbarbelegen in großen europäischen Herbarien und floristischen Übersichten werden Verbreitung und Status (ephemer!) von *Amaranthus polygonoides* L. (*Amaranthaceae*) in Europa diskutiert. Taxonomische Anmerkungen, Beschreibung und Abbildungen dieser Art, sowie ein Schlüssel für vier Arten von *A.* subg. *Albresia* sect. *Pentamoron*, sind ebenfalls enthalten.

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1. Introduction

Amaranthus L. (*Amaranthaceae*) is a genus of about 70 mostly annual monoecious and dioecious species of worldwide distribution. Approximately 40 species occur in North America, most of which are native to this region. The remaining ones are native to other continents (COSTEA & al. 2001a).

In America the genus includes species with extremely high economical value, most of which are grown as vegetables or pseudo-cereals (BRENNER & al. 2000). In Europe these crops are seldom grown (e. g. in 2008 65ha grain amaranths in Austria: GIMPLINGER & al. 2009), but some species are often used as ornamentals (e. g. *A. caudatus* L., *A. cruentus* L., *A. hypochondriacus* L.).

Most of the species of *Amaranthus* that are recorded in Europe are introduced. They are considered alien species and could have economic (crop weeds) and social (allergenic plants) impacts. Fundamental requirement of the European Biodiversity Strategy and the EU Action Plan (European Commission, 2006) make an evaluation of the invasive status (sensu PYŠEK & al. 2004) and the distribution necessary. In this paper, the observations on the presence and the invasive status of *Amaranthus polygonoides* L. in Europe are provided and discussed.

2. Materials and Methods

The work was carried out by reviewing literature, the examination of herbarium specimens and through floristic surveys.

The following literature was analyzed: BERTOLONI 1854, PAOLUCCI 1890, CARUEL 1893, FIORI & PAOLETTI 1900–1902, SACCARDO 1909, TERRACCiano 1910, 1917, THELUNG 1914, FIORI 1923, VASILENKO 1936, PRISZTER 1949, 1952, CLAPHAM & al. 1952, MORARIU 1952, VAN OOSTSTROOM & REICHGELT 1958, AELLEN 1959, 1964, BRENNAN 1961, CACCIATO 1966, GUSEV 1972, GUINOCHET & VILMORIN 1973, FREY 1974, ZANGHERI 1976, CARRETERO 1979, 1985, 1886, 1990, PIGNATTI 1982, JALAS & SUOMINEN 1980, CLAPHAM & al. 1981, GREUTER & al. 1984, HÜGIN 1986, 1987, PAPAISTO & al. 1988, VIEGI & al. 1990, POLDINI 1991, STACE 1991, 1997, AKEROYD 1993, CLEMENT & FOSTER 1994, LUCCHESI 1995, ANZALONE 1996, STRID & TAN 1997, CONTI 1998, COSTEA 1998, WISSKIRCHEN & HAEUPLER 1998, MARTINČIĆ & al. 1999, WEBER 1999, AICHELE & SCHWEGLER 2000, BOVIO & al. 2000, HAEUPLER & MUER 2000, JONSELL 2001, POLDINI & al. 2001, ESSL & RABITSCH 2002, PRESTON & al. 2002, PYŠEK & al. 2002, VIEGI & al. 2004a, 2004b, CONTI & al. 2005, VERLOOVE 2006, CONTI & al. 2007, BORŠIĆ & al. 2008, PANDŽA & TAFRA 2008, CELESTI-GRAPOW & al. 2009a, 2009b, IAMONICO 2009. In addition, web sites were examined (KERGUELEN 1999, WOLHGEMUTH & al. 1999–2001, Flora of Northern Ireland 2009, International Plant Names Index 2006, International Organization for Plant Information 2006, NIKOLIC 2006, DAISIE 2008, Tela Botanica 2009, Tropicos 2009), some of which refer to virtual Herbaria [Muséum National d'Histoire Naturelle 2004 (MNH), The Herbarium Catalogue 2006 (K), Fairchild Tropical Botanic Garden 2007 (FLAS, MO, NY, S, BM, CAYM, INB and TAMU), AUU Herbarium Database 2008 (AAU), RÖPERT 2008 (B), Virtual Herbaria 2008 (GZU, JE, W and WU),

Database of Zürcher Herbarien 2008 (Z, ZT and ZSS), Harvard University Herbaria 2009 (GH and NECB), Nationaal Herbarium Nederland 2009 (L, U, WAK)].

The following Herbaria were checked: AO, APP, AQU, B, BC, BI, BOLO, BOZ, BR, C, CAT, CGE, CLF, E, FI[0], FR, G, GDOR, IS, K, L, LEC, LECB, LG, LINN, LJU, M, MA, MANCH, MHA, MRSN, MSB, MSNM, MW, NAP, NMW, PAD, PAL, PERU, PESA, PI, RO, ROV, S, TO, TSB, URT[0]. The following personal collections (not listed in the Index Herbariorum) were also checked: Dr. A. ALESSANDRINI (Bologna, Emilia-Romagna region, northern Italy), Dr. C. ARGENTI (Belluno, Veneto, northern Italy), Dr. F. BARTOLUCCI (L'Aquila, Abruzzo, central Italy), Prof. G. BAZZICHELLI (Roma, Lazio, central Italy), Dr. M. IBERITE (Latina, Lazio, central Italy), Dr. E. Del GUACCHIO (Salerno, Campania, southern Italy), Mrs. E. LATTANZI (Roma, Lazio, central Italy), Dr. A. PAVESI (Roma, Lazio, central Italy), Dr. A. SOLDANO (Vercelli, Piemonte, northern Italy), Dr. A. TISI (Torino, Piemonte, northern Italy).

3. Records in Europe

In Europe the genus *Amaranthus* includes 29 taxa plus 10 hybrids (GREUTER & al. 1984, AKEROYD 1993, DAISIE 2008, PYŠEK & al. 2009), most of which (c. 24) are native to the Americas, while others are believed to be native to Asia (2 taxa), Europe (2 taxa) and Africa (1 taxon) (according to MOSYAKIN & ROBERTSON 1996 the origin of some species remains still uncertain).

The analysis of the literature and on-line meta sources proved that *A. polygonoides* is not much common in European countries (see below). In the most important European Herbaria, specimens of *A. polygonoides* collected from European countries are absent, except for E, FI, G, L, LG, NAP, PAD and RO.

Belgium. – DE LANGHE & al. 1973 do not report *A. polygonoides* for Belgium. Subsequently, VERLOOVE 2006 recorded the species in Goé (Walloon region, southern Belgium), based on DUVIGNEAUD & LAMBINON 1976. The same author considers the species as a possible “wool-adventive” [F. VERLOOVE (in verbis) also confirmed this]. The voucher is kept in LG only.

Finland. – JONSELL 2001 quoted *A. polygonoides* as a rare casual for Finland, in Korsnäs town (western Finland, Ostrobothnia). DAISIE 2008 did not report the species for this country. No specimens were found in any herbarium.

France. – KERGUELEN 1999 recorded *A. polygonoides* as doubtful for France. ‘Tela Botanica’ 2009 reported the species but does not indicate any Province. No specimens from France were found in European herbaria.

Germany. – THELLUNG 1914 recorded *A. polygonoides* in Berlin (at the Botanical Garden), Dresden, Hamburg and Falkental as an ephemeral species. AELLEN 1959 reported the same localities as THELLUNG 1914. WISSKIRCHEN & HAEUPLER 1998, HAEUPLER & MUER 2000 and ‘DAISIE’ 2008 did not indicate the species for Germany. No specimens collected in Germany were found in herbaria in Europe.

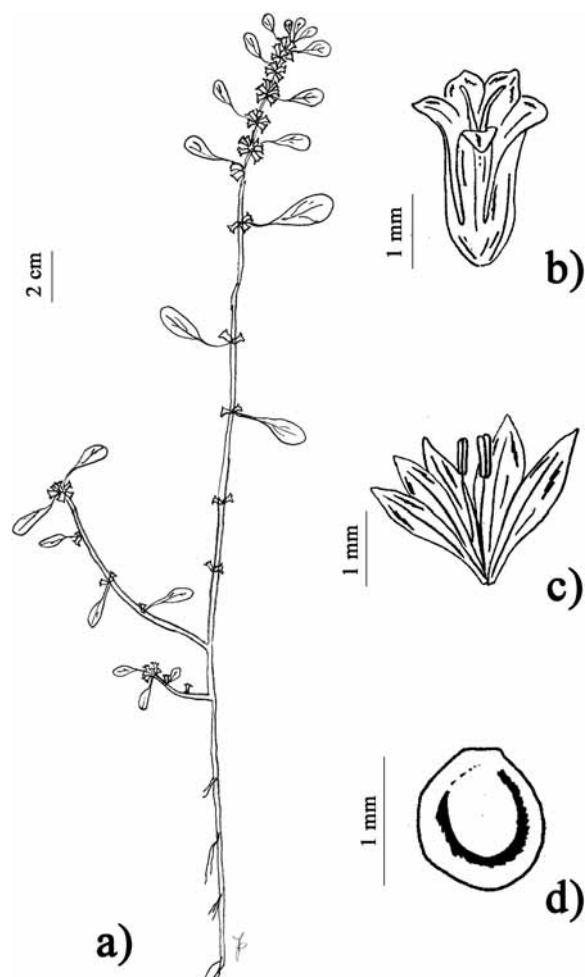


Fig. 1. *Amaranthus polygonoides* L.: a) habitus; b) female flower; c) male flower; d) seed (drawing by D. IAMONICO).

Italy. – The first quotation of *A. polygonoides* in Italy was reported by TENORE 1831 “in maritimis Adriatici: Pescara”. Subsequently, SANGUINETTI 1864 indicated this species for Porto d’Ascoli and San Benedetto (Marche region). BERTOLONI 1854, CARUEL 1893, ARCANGELI 1894 and CESATI & al. 1884 did not report *A. polygonoides* for Italy. FIORI & PAOLETTI 1900–1902 indicated it as “inselvat. nelle sabbie mar. del Piceno a Porto d’Ascoli, S. Benedetto, ecc. (Sanguinetti), a Pescara? (Ten.) e nell’Orto bot. Di Mantova (Ex Spec. Hb. Pat.)”. SACCARDO 1909 also quoted the records by TENORE 1831, SANGUINETTI 1864 and FIORI & PAOLETTI 1900–1902. BÉGUINOT &

MAZZA 1916 refer to FIORI & PAOLETTI 1900–1902 for this species. FIORI 1923 reported the same sites “avvent. nell’Orto bot. di Mantova e lungo il lit. del Piceno a Porto d’Ascoli” and doubtfully at “S. Benedetto e Pescara” (the author certainly refers for “S. Benedetto” to San Benedetto del Tronto, a little town of Marche). ZANGHERI 1976 reported *A. polygonoides* as an ephemeral species, without indicating any locality. PIGNATTI 1982 recorded *A. polygonoides* for Marche (Porto d’Ascoli and San Benedetto del Tronto), while its presence in Abruzzo (Pescara) is doubtful. CONTI & al. 2005 confirmed the species for Marche and they also recorded it for Lazio and Molise regions. In the subsequent update of the Checklist of the Italian Vascular Flora, CONTI & al. 2007 list one new record and the species is considered as “no longer recorded” for Abruzzo (according to TENORE 1831 and CESATI 1873). Recently, IAMONICO 2009 clarified the Italian situation and he reported *A. polygonoides* as an ephemeral species not recorded since 1950 in Lombardia, Trentino-Alto Adige, Marche, Abruzzo and Campania regions. The Italian specimens are kept in FI, NAP (here the oldest Italian specimen is kept, which was collected by G. GUSSONE before 1817 from “Golfo di Napoli”), PAD and RO. In the other European herbaria two Italian specimens were found, both kept in G and correctly identified (rev. D. IAMONICO, 13 september 2010, from photos of the specimens). The first one was collected by A. BRUNI in 1860 from Barletta (region of Puglia) and represents the first record for the southern Italian region; no quotation of the species was reported by BRUNI 1857). The other specimen has a doubtful provenance. In fact, the label reports “plante de l’Italie centrale. prov. du Jardin de Grunddorf” [“plant of central Italy from the Garden of Grunddorf”] (without collector, 1822). Two villages with the name Grunddorf exist in Lower Austria in the W. and W. N. W. of Vienna. It is possible that the plant was collected in central Italy and subsequently cultivated in Austria. However, this is only an hypothesis and therefore, no quotation in specimen visa and no mark in the map (Fig. 2) are given.

The Netherlands. – VAN OOSTSTROOM & REICHGELT 1958 reported *A. polygonoides* as a wool alien for Tilburg. In Nationaal Herbarium Nederland (L) are kept 5 specimens that were collected between 1955 and 1962 in Tilburg. Examination of the photos of the specimens allowed to confirm the determinations as *A. polygonoides*. AELLEN 1959 also indicated the species “...auch in den Niederlanden”, but does not report any locality. ‘DAISIE’ 2008 did not report the species for this country.

Spain. – CARRETERO 1986 recorded *A. polygonoides* in Spain (Santander Province) based on exsiccata kept in MA. Subsequently, the species was reported as casual in Spain (CARRETERO 1990).

Sweden. – JONSELL 2001 did not quote *A. polygonoides* for Sweden. The P. D. GISEKE collection in E contains one specimen. Two labels are in-

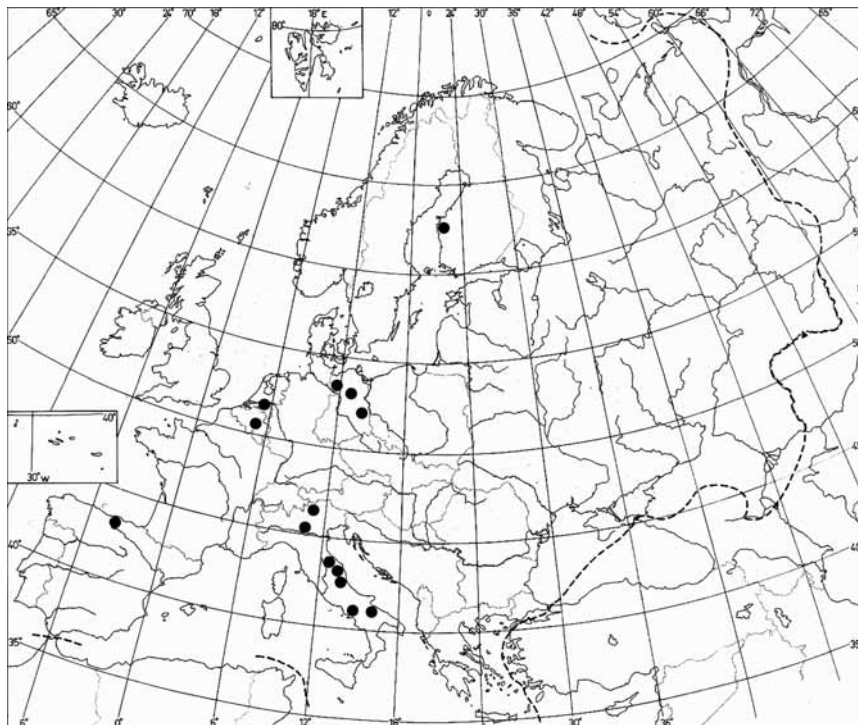


Fig. 2. Distribution map of *Amaranthus polygonoides* in Europe.

cluded. One of these only quoted the name "*Amaranthus albus*" (no data, no locality and no collector). The other label quoted "*A. polygonoides* subsp. *polygonoides* – Determinavit Aellen 1964" (no locality was indicated). Examination of the specimens allowed to confirm the determination by AELLEN. With regard to the locality, two considerations are needed. GISEKE was a Swedish botanist. AELLEN was an eminent botanist who was an expert on the genus *Amaranthus* in Europe (he was author for this genus in the first edition of the *Flora Europaea*). Therefore, I suppose that this specimen is an European one. The inclusion of the specimen in P. D. GISEKE collection induces me to consider *A. polygonoides* as a doubtful species for Sweden. 'DAISIE' 2008 not reported the species for this country.

The distribution of *A. polygonoides* in Europe is shown in Fig. 2. Cultivated specimens [from Italy (Toscana region) – see IAMONICO 2009 for details] are not indicated.

Specimina visa: Belgium, Wallonia, Béthune (Goé), Adv. Laineir dans la cour du lavoir, 16 Sep 1959, N. CNOPS (sub. *A. vulgatissimus* SPEGAZ.), rev. J. DUVIGNEAUD & J. LAMBINON (LG). – Italy, Abruzzo, Giulia, sine die (ante 1831), M. TENORE (NAP). – Italy, Campania, Golfo di Napoli, sine die (ante 1817), G. GUSSONE

(NAP, Herb. GUSSONE). – Italy, Puglia, Barletta, 1822, leg. A. BRUNI (G). – Italy, Marche, Ascoli, sine die (century XIX), sine collectore, det. G. LUSINA (RO). – Italy, Marche, Porto d'Ascoli, Jul 1839, leg. P. SANGUINETTI, det. G. LUSINA (RO). – Italy, Marche, Senigallia, sui binari della stazione ferroviaria, 30 Jun 1946, A. BETTINI (FI). – Italy, Marche, ibidem (FI). – Italy, Marche, ibidem (FI). – Italy, Marche, da semi di piante di Senigallia sul mio terrazzo in vaso, 22 Jul 1949, A. BETTINI (FI). – Italy, Lombardia, nasce nell'Orto botanico di Mantova spontaneo, sine die (XIX century), sine collectore (PAD). – Italy, Lombardia, nelle sabbie e negli incolti nel mantovano, Mar 1877, BARBIERI (FI). – Italy, Toscana, Giardino dei Semplici, 1820, sine collectore (FI). – Italy, Toscana, Hort. Bot. Bonon, 1829, P. BUBANI (FI). – Italy, Toscana, H° Pisano, 1839 ect., sine collectore (FI). – Italy, Toscana, H. Bot. Mus. Flor., 27 Jun 1857, sine collectore (FI). – Italy, Veneto, Orto Botanico di Padova, coltivato, Aug 1896, Adr. FIORI (FI). – The Netherlands, Brabant, Tilburg, 19 Sep 1955, J. H. KERN, S. J. VAN OOSTSTROOM & T. V. REICHGELT 0823314 (L). – The Netherlands, Brabant, ibidem 0823316 (L). – The Netherlands, Brabant, ibidem 0823317 (L). – The Netherlands, Brabant, Tilburg, 01 Sep 1958, J. H. KERN, S. J. VAN OOSTSTROOM & T. V. REICHGELT 0823315 (L). – The Netherlands, Brabant, Stortterrein afval Tilburg e Wolwasserij, 13 Sep 1962, leg. J. DORGELO, det. F. ADEMA 0823313 (L). – sine loc., 1964, P. AELLEN 00295340 (E).

4. Taxonomical Notes

- Amaranthus polygonoides* L., Pl. Jamaic. Pug.: 27. 1759 (Fig. 1)
 = *Roemeria polygonoides* (L.) MOENCH, Methodus: 341. 1794, nom. illeg.
 = *Amblogyna polygonoides* RAF., Fl. Tellur. 3: 42. 1837
 = *Albersia polygonoides* (L.) KUNTH, Fl. Berol., ed 2, 2: 144. 1838
 = *Sarratia berlandieri* MOQ., in DC. Prodr. 13(2): 268 (-269). 1849
 = *Amblogyna polygonoides* DANZELL & A. GIBSON, Bombay Fl.: 219. 1861, nom. illeg.
 = *Amaranthus berlandieri* (MOQ.) ULINE & W. L. BRAY, Bot. Gaz 19: 268. 1894
 = *Amaranthus polygonoides* L. BRAY subsp. *berlandieri* (MOQ.) THELL., in ASCHERSON & GRAEBNER, Syn. mitteleur. Fl. 5: 352 (-353). 1914
 = *Amaranthus taishanensis* F. Z. LI & C. K. NI, Acta Phytotax. Sin. 19(1): 116. 1981

Amaranthus polygonoides was first described by LINNAEUS 1759 from "Jamaica". The names *A. polygonoides* ROXB. (ROXBURGH 1832) and *A. polygonoides* ZOLL. (ZOLLINGER 1845) are illegitimate. More recently LI & NI 1981 described the new species *A. taishanensis* F. Z. LI & C. K. NI, but LI & al. 2002 clarified its identity and the species was considered conspecific with *A. polygonoides*. The epithet "*polygonoides*" was used in several nomenclatorial combinations at subspecies or variety ranks, but often referring to *A. blitum* L. subsp. *emarginatus* (MOQ. ex ULINE & BRAY) CARRETERO, MUÑOZ GARMENDIA & PEDROL (see COSTEA & al. 2001b).

The genera *Roemeria* MOENCH (MOENCH 1794; this name is a later homonym of *Roemeria* MEDIK., so it is illegitimate under the art. 53.1 of the

ICNB - Vienna Code), *Amblogyna* RAF. (RAFINESQUE 1836), *Scleropus* SCHRAD. (SCHRADER 1835) and *Sarratia* MOQ. (MOQUIN-TANDON 1849) are considered synonyms of *Amaranthus*; so the names *Roemeria polygonoides* (L.) MOENCH, *Amblogyna polygonoides* RAF. [= *Amblogyna polygonoides* DANZELL & A. GIBSON., nom. illeg. (DANZELL & GIBSON 1861)] and *Scleropus amaranthoides* SCHRAD. are synonyms of *Amaranthus polygonoides*. Regarding *Sarratia*, MOQUIN-TANDON 1849 reported “*Ambloginae* affinis; differt...utriculo circumscisse dehiscente”; he also described the new species *S. berlandieri* MOQ. and excluded the species *Sarratia polygonoides* MOQ. (this was indicated as synonym of *Amblogyna polygonoides* RAF.). Subsequently, ULINE & BRAY 1894 accepted the species rank and proposed the new combination *A. berlandieri* (MOQ.) ULINE & W. L. BRAY; based on these authors *A. berlandieri* should differ from *A. polygonoides* in having an indehiscent utricle. *A. berlandieri* was often recognized as a separate species related to *A. polygonoides* during the 20th century, although THELLUNG 1914 proposed the combination *A. polygonoides* subsp. *berlandieri* (MOQ.) THELL. Recently, HENRICKSON 1999 clarified the confusion that existed in earlier descriptions of these two taxa and showed that the characters used for the separation between the two units (mainly dehiscent vs. indehiscent utricles) are inconsistent and cannot be applied for the segregation of two independent species. The Flora of North America (MOSYAKIN & ROBERTSON 2003) also reports *A. berlandieri* as a synonym of *A. polygonoides*. In the present treatment we follow the solution proposed by HENRICKSON 1999.

Based on MOSYAKIN & ROBERTSON 1996, *A. polygonoides* can be provisionally included in the subgen. *Albersia* GREUT. & GODR. sect. *Pentamorion* (G. BECK) MOSYAKIN & K. R. ROBERTSON, which includes species with axillary inflorescences, five tepals (rarely four) and indehiscent fruits (the authors have not quoted this species in their paper and they moreover highlighted that the classifications of the sect. *Pentamorion* and the whole subgen. *Albersia* need additional studies). In particular, *A. polygonoides* belongs to the South-american group [with *A. crispus* (LESP. & THÉV.) N. TERRACCIANO, *A. crassipes* SCHLECHT. and *A. pumilus* RAF., according to MOSYAKIN & ROBERTSON 2003] which is biogeographically separated from the Australian group (with *A. mitchellii* BENTHAM, *A. interruptus* R. BR. and probably *A. pallidiflorus* F. VON MUELL., *A. clementii* DOMIN, according to MOSYAKIN & ROBERTSON 1996).

5. Description

The following analytic key shows the main diagnostic characters of the related species included in the South-american group of the sect. *Pentamorion* [all are recorded from Europe except for *A. pumilus* (e.g. AKEROYD 1993, CONTI & al. 2005, ‘DAISIE’ 2008)].

- 1. Tepals connate in proximal 1/3 and patent above .. *A. polygonoides*
- 1. Tepals free, never patent 2
- 2. Leaf blade with margins crisped or strongly undulate *A. crispus*
- 2. Leaf blade with margins entire or slightly undulate 3
- 3. Axis of the inflorescences thickened or indurate at maturity *A. crassipes*
- 3. Inflorescence axes never thickened or indurate at maturity *A. pumilus*

A. polygonoides clearly differs from other species in the characters of the tepals (see key) as highlighted by LINNAEUS 1759, where noticed in the species protologue “Calycibus infundibuliformibus obtusis singularis”. SCHLECHTENDAL 1831 in his diagnosis of *A. crassipes* also wrote “Species affinis *A. polygonoidi*...florum diversa configuratio...”.

Based on personal observations, a detailed description and original iconography (Fig. 1) of *A. polygonoides* is given in the following.

Prostrate or ascending annual (therophyte) 0.3–0.4 m, with glabrous stem. Leaves ovate (0.3–1 × 0.6–2 cm), with cuneate base and obtuse (sometimes emarginate) apex; margins usually undulate; petiole equalling the blade. Flowers in axillary clusters. Bracts of pistillate flowers ovate to lanceolate, about 1 mm long, shorter than the tepals. Tepals 5, equal, connate in the proximal 1/3 and patent above, 2–3 mm long, obovate to spatulate, with apex rounded or retuse, mucronate. Fruit indehiscent, 2–2.5 mm, ellipsoidal, about equalling tepals. Seeds 0.8–1 mm in diameter, lenticular, red-brown to black, shiny.

Chromosome number: $2n = 34$ (SONG & al. 2002).

Native in tropical America (MOSYAKIN & ROBERTSON 2003).

Habitat: disturbed areas.

Phenology: Flowers: July to September. – Fruits: August to October

6. Conclusions

Consequently, following the notes in chapter 3, *A. polygonoides* has to be considered a rare and no longer recorded species in Europe, collected only in Belgium, Italy, the Netherlands, Spain and is doubtfully recorded for France and Sweden (for Finland and Germany only quotations in literature were found). Based on PYŠEK & al. 2004, this neophyte may be considered an ephemeral for Europe temporarily occurring in man-made habitats. The oldest European record of *A. polygonoides* refers to a spontaneous plant kept in NAP and was collected by G. GUSSONE before 1817 in southern Italy (“Golfo di Napoli”, Campania region). The newest record with indication of its locality is from 1962 from the Netherlands.

7. Acknowledgements

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