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Taxonomical and chorological remarks on the Mediterranean *Poa maroccana* (Poaceae) and first record in Italy from Sicilian flora

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Runing title: Taxonomy and chorology of Poa maroccana

Abstract – *Poa maroccana* is an annual Mediterranean species, which is recorded for the first time from Sicily and for the whole Italian territory. It usually occurs in synanthopic habitats, represented mainly by urban and suburban roadsides, where it is quite sporadic. Based on current knowledge, it has been hitherto reported only in a few localities of the Mediterranean area, particularly in Morocco, Algeria, Tunisia, Libya, Spain, Portugal, Greece, Turkey, Syria and Crimea. Field observations and herbarium investigations have shown that this species is often mistaken for *P. annua*, mainly due to its morphological similarities, as well as for the same ecological needs, therefore its real geographical distribution has yet to be verified. Although the two species are both tetraploids (2n = 28), they clearly differ for numerous relevant features concerning the shape and size of ligules, inflorescence, spikelet, glumes, palea, lemma, anthers, lodicules and seed. In order to better clarify the relationships of *P. maroccana* with *P. annua* and the other annual species of this genus occurring in the Mediterranean, its carefull a morphological description and iconography is provided, as well as a comparative morphological table of all allied species and also their analytical key for easy identification.

Keywords: annual Poa, chorology, Italy, morphology, Sicily

Introduction

Within the genus *Poa* L., a large cosmopolitan genus of the family Poaceae, the annual species hitherto known from the Mediterranean flora are examined. According to literature (Chrtek and Jiràsek, 1962, Hernandez Cardona 1978, Edmondson 1980, Nikolić 2000, Böhling and Scholz 2003, Valdés and Scholz 2009, Ibn Tattou and Fennane 2009, Banfi 2017, Cabi et al. 2017, Ortega-Olivencia and Devesa 2018, Brullo et al. 2019), they are currently represented by at least six taxa, such as *Poa annua* L., *P. infirma* Kunth, *P. dimorphantha* Mürbeck, *P. cyrenaica* E.A.Durand & Barratte, *P. jubata* A.Kern. and *P. maroccana* Nannf. All these species, except the last one, are usually considered in literature as well distinct species, which differ from each other in several morphological characters, as well as in ecological requirements, chromosome complement, taxonomic and phylogenetic position (Nannfeldt 1938, Camus 1952, Tutin 1957, Gillespie et al. 2005, 2007, Cabi et al. 2017, Tkach et al. 2020). As concerns *P. maroccana*, it has been often treated as a doubtful taxon (cf. Edmondson 1980, Valdes et al. 2002, Strid 2016) or not quoted at all

(cf. Ortega-Olivencia and Devesa 2018). Based on a large amount of literature data (Nannfeldt 1938, Litardière 1938, 1939, Camus 1952, Tutin 1957, Chrtek and Jiràsek 1962, Scholz 1968, 1993, 1996, Böhling and Scholz 2003, Valdés and Scholz 2006, 2009, Valdes 2013, Dimopoulos et al. 2013, Ibn Tattou 2014, Nosov et al. 2019), *P. maroccana* must be conversely considered a species morphologically well differentiated from all the other species belonging to the cycle of *P. annua*.

This species was described by Nannfeldt (1938) based on herbarium materials collected by Samuelsson in Morocco during a trip of 1936 and also on cultivated plant using seeds taken from these specimens. Besides, this author emphasized that *P. maroccana* shows close relationships with P. infirma, since both share loosely arranged and strongly compressed culms, lower inflorescence branches erect-patent after anthesis, spikelets with remote flowers not hiding the rachilla, apical flower long no more than a half of its pedicel and all lemma nerves densely villous. However, they clearly differ in some relevant features, since P. maroccana is characterized by a larger size, with culms up to 40 cm high, much longer leaf blades, larger spikelets (5–7.5 mm long), much longer bracts, anthers 0.7-1.2 mm long, while P.infirma shows a small size, with culms 5-20 cm high, usually shorter leaf blades, smaller spikelets (2-4 mm long), shorter bracts, anthers 0.2-0.5 mm long. The two species also differ in the chromosomic complement, which is tetraploid (2n = 28) in P. maroccana and diploid (2n = 14) in P. infirma, as investigated by Nannfeldt (1938) and Litardière (1938, 1939). Another species quite similar to P. maroccana is P. annua, which is also tetraploid with 2n = 28, but showing a remarkable morphological variability (Tutin 1957, Mao and Huff 2012). Within the latter, in fact, numerous infraspecific taxa (subspecies or varieties) are known in the literature (Valdés and Scholz 2006, Ortega-Olivencia and Devesa 2018), of which P. annua subsp. pilantha (Ronniger) H.Scholz is that one having greater similarities with P. maroccana, especially for the lemma nerves provided with long hairs (Scholz 1968). In particular, P. annua, which on a superficial observation could confuse with P. maroccana, differs very well from the latter for its slightly compressed and often creeping bases rooting culms, ovate-triangular and irregularly denticulated ligules, lower inflorescence branches spreading or deflexed after anthesis, spikelets with compact flowers hiding the rachilla, apical flower at least double as long as its pedicel and all lemma nerves usually subglabrous (rarely glabrous as in var. raniglumis Fröhner) or sparsely hairy, anthers lightly schorter (0.6–0.8 mm). Besides, recent molecular investigations carried out by Nosov et al. (2019) have confirmed that P. maroccana is an autotetraploid of P. infirma, origin previously hypothesized by Chrtek and Jiràsek (1962) and Scholz (1996). It should be noted that an eventual taxonomic affinity between P. maroccana and P. annua must be excluded in any case, since on the basis of experimental hybridizations carried out by Nannfeldt (1938), where the hybrids obtained were characterized by a chromosome count (2n = 28) and were completely sterile (Chrtek and Jiràsek 1962, Warwick 1979). Triploid hybrids (2n = 21) originated by crossing between P. maroccana and P. infirma, were also observed occasionally on the island of Crete by Scholz (1996) and were described as *P. x perinconspicua* H. Scholz (cf. Scholz 1998); they are sterile or in any case with low fertility (see Nannfeldt 1938, Scholz 1993). Basing of these results, it can therefore assert that P. maroccana from the morphologically, caryologically and molecularly viewpoint must be considered a species taxonomically well-distinct from other taxa belonging to the cycle of P. annua, having clear phylogenetic correlations only with P. infirma.

As concern its taxonomic arrangement, *P. maroccana* falls within *P.* sect. *Ochlopoa* described by Ascherson and Graebner (1900), which groups species with annual or sometimes short-lived perennial habit, culms erect or shortly creeping, leaves flat, inflorescence branches smooth, lemma not lanate at base and more or less hairy in the nerves (Edmondson 1980). Later, Scholz (2003) and Valdes and Scholz (2006) considered more appropriate to arranged the species belonging to this section in a distinct genus, named *Ochlopoa* H.Scholz, including also *P. maroccana*. However, this treatment is not supported by the recent phylogenetic approaches that using nuclear and plastidial sequences have established that *Poa* is a large monophyletic genus, showing a cosmopolitan distribution, with about 550–575 species currently recognized (Gillespie and Soreng 2005, Gillespie et al. 2007, 2018, Joshi et al. 2017, Sorgen et al. 2015, 2017, Refulio-

Rodriguez et al. 2012, Hoffmann et al. 2013, Cabi et al. 2017, Nosov et al. 2019, Tkach et al. 2020). Besides, these investigations emphasized that within *Poa* must be included many other species formerly attributed to other genera, formerly considered closely related to the latter. In particular as emphasized by Gillespie et al. (2018) and Tkach et al. (2020) within *Poa* must be placed both *Lindbergella sintenisii* (H. Lindb.) Bor described by Linderberg (1942) as *P. sintenisii* and later by Bor (1968, 1969) included in the monospecific genus *Lindbergella*, accepted in literature as endemic from Cyprus (Meikle 1985, Watson and Dallwitz 1992, Soreg et al. 2015), as well as *Libyella cyrenaica* (Durand & Barratte) Pamp., also it initially was attributed by Durand and Barratte (1910) to the genus *Poa*, but by Pampanini (1925) recognized it as a taxonomically isolated species and referred it to a new genus endemic from Cyrenaica, named *Libyella*, treatment recognized by later other authors (Maire 1953, Sherif and Siddiqi 1988, Watson et al. 1992, Soreg et al. 2015). Recently, Gillespie et al. (2018) and Tkach et al. (2020) arranged within *Poa* also several annual species of *Eremopoa* Roshev., distributed in western and central Asia up to the Himalayas chain.

From the above-mentioned literature, six subgenera have been recognized within *Poa*, all of them usually well supported by the phylogenetic studies. They are the followings:

Poa L., Sp. Pl. 1: 67-70, 1753

Synonyms – Anthochloa Nees & Meyer, Reise Erde 2:14, 1834; Dissanthellium Trin., Linnaea 10:305, 1836; Aphanelytrum (Hack.) Hach, Oesterr. Bot. Z. 52:12, 1902; Libyella Pamp., Bull.Soc. Bot. Ital: 1925: 151, 1925; Lindbergia Bor, Svensk Bot. Tidskr 62: 467, 1968, nom illeg. non Kindb. 1897; Lindbergella Bor., Svensk Bot. Tidskr 63: 368, 1969; Eremopoa Roshev., Fl. URSS 2:429, 756, 1934; Austrofestuca (Tzvelev) E.B. Alexeev, Bjull. Moskovsk. Obàc, Isp. Prir. Biol. 81:35, 1976; Tovarochloa T.D. Macfarl. & But, Brittonia 34:478, 1982; Neuropoa Clayton, Kew Bull. 48:728, 1985; Tzvelia E.B. Alexeev, Bjull. Moskovsk. Obàc, Isp. Prir. Biol. 90: 103, 1985; Ochlopoa H. Scholz in Böhling & Scholz, Ber. Inst. Landschfts-Pflanzenökologie Univ.Hohenlm, Beih. 16: 58, 2003; Oreopoa H. Scholz & Parolly, Willdenowia 34: 146, 2004.

Subgen. *Poa*, including Supersect. *Poa*, with 4 Sections and Supersect. *Homalopoa* (Dumort.) L.J. Gillespie, with 10 Sections.

Subgen. Ochlopoa (Asch. & Graebn.) Hylander, with 4 Sections.

Subgen. Artopoa (Griseb.) Prob., with 2 Sections:

Subgen. Sylvestres (V.L. Marsh ex Soreng) Soreng and L.J. Gillespie, with 1 Section.

Subgen. Pseudopoa (K. Koch) Stapf, with 3 Sections.

Subgen. Stenopoa (Dumort.) Soreng and L.J. Gillespie, with 6 Sections.

In particular, the annual species of *Poa* occurring in the Euro-Mediterranean territories are distributed in various Subgenera and Sections. Among these, the taxa belonging to the *P. annua* cycle, such as *P. annua* s. str., *P. infirma* and *P. maroccana*, as well as *P. dimorphonantha* and *P. cyrenaica*, morphologically more isolated, are included within the Subgen. *Ochlopoa*, described by Hylander (1953), and in particular in the Sect. *Micrantherae* Stapf (= Sect. *Ochlopoa* Asch. & Graeb.), while *P. sintenisii* is arranged in the the Sect. *Linbergella* (Bor) Soreng, Cabi & L.J. Gillespie of the Subgen. *Pseudopoa*. Finally, *P. jubata* was referred by Cabi et al. (2017) to the sect. *Jubatae* a monotypic section whose attribution to a distinct subgenus is currently uncertain (cf. Brullo et al. 2019). According Nosov et al. (2019), all these taxa have been gathered to 'basal Old World *Poa* s. str.', diverging phylogenetically from other groups of annual *Poa* occurring in America, which belong to other subgenera and section, such as Subgen. *Poa* (Supersec. *Homalopoa*, Sect. *Homalopoa* and *Macropoda*) or in the primitive Sect. *Paradiochloa*. Much more complex is the positions of the numerous annual *Poa* species of the East Asian territories, since part of them seem to have a hybridogenic origin among the taxa of Sect. *Homalopoa* and those ones of

Stenopoa, that do not allow to refer them clearly to the Subgen. *Poa* or to the Subgen. *Stenopoa* (cf. Nosov et al. 2019).

In Italy, from the literature (Banfi 2017, Bartolucci et al. 2018, Brullo et al. 2019, Conti et al. 2020), 29 species of the genus *Poa* are currently recorded, to which must be added *P. maroccana* too. As already pointed out, this species, showing a markedly thermophilous character, has probably a Mediterranean underestimated distribution. The reason is mainly due to the apparent similarity of *P. maroccana* with *P. annua*, with which due to its habit it can be easily confused. This also occurred in the casual discovery in Sicily of populations correctly attributable to *P. maroccana*, species that must be considered a new record for the vascular flora of the island, as for the whole Italian territory. This plant was first noticed along the edges of the urban roads of Catania (E Sicily), which attracted our attention for its vigorous and robust habit, very different from that one of *P. annua*, which is much more slender, with which it was often mixed. Later, it was collected also along the urban roads of Giarre (N of Catania), but it is very probable that for the aforesaid reasons it may occur also in other Sicilian and Italian localities. Future and careful investigations could certainly expand its current distribution.

Materials and methods

The morphological analysis on *Poa maoccana* was carried out on living specimens collected in urban stands of Catania and Giarre (Sicily), as well as on herbarium materials (viewed mainly online) kept in B, BC, BM, CAT, DAO, E, FR, GH, HSS, L, LD, LE, M, MA, MO, MPU, S, UPA and W (abbreviations are according to Thiers 2020). For the identification of *P. maroccana* were used the morphological description, drawings and keys provided by Nannfeldt (1938), Camus (1952), Chrtek and Jiràsek (1962), Scholz (1996) and Brullo et al. (2019).

As concerns the processing of the morphological data listed in Table 1, it was based on analysis of herbarium specimens, as well as on the literature treating the description of the mentioned species (Pampanini 1925, Nannfeldt 1938, Camus 1952, Maire 1953, 1955, Edmondson 1980, 1985, Meikle 1985, Watson et al. 1992, Zu et al. 2006, Ibn Tattou 2014, Clayton et al. 2016, Banfi 2017, Brullo et al. 2019).

Results

Poa maroccana Nannf., Svensk Bot. Tidskr. 32: 296, 1938 (Fig. 1)

Lectotype – Iter Algeriense-Maroccanum, Flora Maroccana. Distr. boreali-centralis Taza in fossa ad viam, ca. 450 m. s. m., 1/5/1936, *Gunnar Samuelsson* 7256 (S-G-6765!), designated by Scholz (1993); isotypes (MPU 010584!, LE 00009663!, GH 00024370!, LD 1217604!; S 13-31402!).

Synomyms – *Poa annua* L. var. *maroccana* (Nannf.) Litard., Rev. Cytol. et Cytophysiol. Végét., 4: 83, 1939; *Ochlopoa maroccana* H.Scholz in Böhling, & H. Scholz, Ber. Inst. Landschafts-Pflanzenökologie Univ. Hohenheim, Beih.16: 59, 2003.

Description (from Sicilian material) – Annual, glabrous, without rhizomes, tuffed, many stemmed, with intravaginal branching. Culms 10–40 cm tall, erect or weakly geniculate at base, glabrous, with 4–6 nodes. Leves 4–6, with sheath 5–40 mm long, fuser up to 1/3, covered the stem for 1/2 to totally, throat and collar smooth and glabrous; ligule rounded, sometimes triangular-oblong, ca. 1 mm long, glabrous; blade flat, soft, 1.5–4 cm long, 1.5–4.5 mm wide, smooth to slightly scabrous at the margin. Panicle 4–9 cm long, triangular-ovate to oblong-rhombic, erect, lax, open, with 1–2 branches per node, erect to ascending, glabrous. Spikelets 5.5–6.5 mm long, narrowly ovate to oblong-linear, laterally compressed, green, with 4–5(6) spaced florets and well exposed rachilla. Glumes unequal, shorter than adjacent lemmas, glabrous, ovate-oblong to lanceolate, distinctively nerved, with surfaces smooth and hyaline at the margins; lower glume 2–3 mm long, 1-nerved, subacute; upper glumes 2.5–3(4) mm long, 3–nerved, obtuse to subacute.

Lemmas 2.8–3.7 mm long, ovate to ovate-oblong, rounded to rounded-obtuse at the apex, with 5 well distinct nerves, all densely villous and not reaching the margin. Palea hyaline, 2.3–3 mm long, with keels villous throughout their length, shortly ciliolate along the upper 2/3, bifid at the apex, with flanges appressed. Flowers bisexual; lodicules 0.3–0.4 mm long, pyriform, glabrous; anthers 0.7–1.3 mm long, yellow, inserted on very short filaments; styles 0.7–0.8 mm long, plumose. Ovary 0.3 mm long. Caryopsis adherent to palea, 1–1.4 mm long, fusiform, subtrigonous in cross section, hilum incospicous. Flowering time is from January to April.

Karyology – According to the literature (Nannfeldt 1938, Litardière 1938, 1939, Scholz 1993), the investigated material of *P. maroccana* is characterized by a tetraploid chromosome number 2n = 4x = 28. It is therefore well differentiated from the closely related *P. infirma*, which is always diploid with 2n = 2x = 14. Other tetraploid species of *Poa* sect. *Micrantherae* are *P. dimorphantha*, *P. rivulorum* and *P. annua*, while *P. supina* Schrad. is diploid (Nannfeldt 1935, 1938). Unlike *P. annua*, which is an allotetraploid derived from natural hybridization processes among *P. infirma* and *P. supina* (Tutin 1957), *P. maroccana* is an autotetraploid originating from *P. infirma* as hypothesized by Edmondson (1980), Chrtek and Jiràsek (1962), Scholz (1996) and recently confirmed by Nosov et al. (2019).

Habitat and ecology – As concerns its ecological requirements, *P. maroccana* is usually linked to synanthropic stands, represented mainly by roadside, uncultivated areas, gardens, ditches, depressions temporarily submerged and in any case habitats normally affected by anthropic disturbance, characterized by more or less damp and nitrified soils. In these places, it behaves like a ruderal plant, often growing with other annual species of *Poa*, such as *P. annua* and *P. infirma*, as emphasized also by Nannfeldt (1938) and Scholz (1993, 1996).

Geographical distribution – Based on herbarium investigation and literature data (Nannfeldt 1938, Maire and Samuelsson 1939, Camus 1952, Maire 1955, Edmondson 1980; Scholz 1968, 1993, 1996, 1998, 2003, Turland et al. 2004, Valdés and Scholz 2009, Valdés 2013, Dimopoulos et al. 2013, Ibn Tattou 2014, Strid 2016, Zarco 2016, Nosov et al. 2019), *P. maroccana* shows a scattered distribution in many countries of the Mediterranean area (Fig. 2). In particular, it occurs in Morocco, Algeria, Tunisia, Libya, Portugal, Spain, Greece, Crete, Turkey, Syria, Crimea and also in Sicily, representing the latter the first record for the Italian flora too. As previously highlighted by Scholz (1993), *P. maroccana* is most likely more widespread than it might seem based on current information due mainly former misidentifications, as it has already been ascertained by checking the herbarium specimens.

Conservation status – Being a strictly synanthropic species, although native to the Mediterranean and with a real distribution still underestimated, *P. maroccana* does not seem currently to be under threat or taking no risk of disappearance due to anthropic pressure. Therefore, *P. maroccana* can undoubtedly be regarded as an unthreatened species (LC) according to the IUCN protocol (IUCN 2017).

Specimina visa – Algeria: Tenit et Haad en une mare, May 1883, *Trabut 3* (W-Hackel 1916-0007962); Dép. Oran. Mostaganem, 1848, *B. Balansa s.n.* (L 1319919); Dép. Oran: Monts de Tlemcen, lieux humides à Terni, *L. Trabut s.n.* (MPU), see Nannfeldt (1938); Ténira, near Sidi-Bel-Abbès, "lieux humides, 650 m s. m., 11 April 1931, *A. Faure s.n.* (S), see Nannfeldt (1938); ibid. "pelouses vers l'Oued", 650 m s. m., 11 April 1931, *A. Faure s.n.* (MPU), see Nannfeldt (1938); Tiaret, *L. Trabut s.n.* (MPU), see Nannfeldt (1938); ibid. May 1905, *J. A. Battandier s.n.* (MPU), see Nannfeldt (1938); Dèp. Alger: Teniet-el-Had, 25 April 1889, *Mac-Cartthy (?) s.n.* (MPU), see Nannfeldt (1938); mare, May 1883, *L. Trabut 3* (MPU), see Nannfeldt (1938); Rouiba, "lieux humides", *L. Trabut* (MPU), see Nannfeldt (1938); Dép. Constantine: Aïn-Elmelouk, *Joly s.n.* (MPU); see Nannfeldt (1938); Pl. Saharae algerienses Territories du Sud: les oasis: Ouargla, ad margines rivulorum, 3 March 1904, *L. Chevallier 646* (MPU), see Nannfeldt (1938).

Crimea: Crimea, near the settlement Frunzenskoe, Tzvelev s. n. (LE), see Nosov et al. (2019).

Greece: Fthiótis, Fthiotidhos, S Lamia, 1 April 1999, Willing R., Willing E. 73436 (B-JACQ-ID 825003); Évvoia, W Asmini, 11 May 2011, Willing R., Willing E. 217599 (B 10 0403169);

Évvoia, W Edipsos, 10 May 2011, Willing R., Willing E. 217455 (B 10 0403170); Évvoia, SO Prokopi, 06 May 2011, Willing R., Willing E. 216044 (B 10 0403171); Évvoia, NNO Orion, 30 April 2011, Willing R., Willing E. 214031 (B 10 0403172); Évvoia, NO Avlonari, 30 April 2011, Willing R., Willing E. 213778 (B 100403173); Évvoia, S Aliveri, 26 April 2011, Willing R., Willing E. 212512 (B 10 0403174); Évvoia, S Zarakes, 19 April 2011, Willing R., Willing E. 210250 (B 10 0403175); Voiotía, Mavrojia, 10 April 2011, Willing R., Willing E. 207192 (B 10 0403176); Voiotía, SW Orchomenos, 08 April 2011 Willing R., Willing E. 206425 (B 10 0403177); Fokídos, O Itea, 05 April 2011, Willing R., Willing E. 205661 (B 10 0403178); Fokídos, NW Itea, 05 April 2011, Willing R., Willing E. 205411 (B 10 0403179); Voiotía, Thivon, N Vagia, 13 April 1999, Willing E., Eisenblätter R. 76590 (B 10 0733741); Crete, distr. Heraklion: Malia, edge of lawn in a hotel recreation area, with Poa infirma and P. annua, 10.April.1994, H. Scholz s. n. (B), see Scholz (1995); Crete., olive-tree plantation near K. Karouzana N of Kasteli, 17.April.1994, H. Scholz s. n. (B), see Scholz (1995); Crete., potato field and irrigation ditches in the hinterland of the beach near Malia, 22.April.1994, H. Scholz s. n. (B), see Scholz (1995); Crete distr. Lasithi: Lasithi Plateau, near Pinakiano, fallow land, with P. infirma, 15 April 1994, H. Scholz s. n. (B), see Scholz (1995); Crete, Nom. Lasithiou, Ep. Lasithiou: Lasithi plain, SE of Kristallenia monastery, 840 m, large level ploughed field, 4500 m2, many similar fields and orchards in area, 7 April 2003, Bareka, Turland s.n. (B, BM, MO, UPA), see Turland et al. (2004); Crete, Chanion., Ep. Apokoronou, near Georgiopolis, fallow land, 15 April 1996, Scholtz s.n. (B), see Scholtz (2003); Crete, Lasithiou, Ep. Ierapetras, Thripti, weedy vineyard, 700 m alt., 24 March 1998, Bohling, Raus 7218 (B), see Scholtz (2003); Crete, Ep. Lasithiou, Ag. Kroustalenias, open weed vegetation on seasonally wet field, 820 m alt., 01 May 1997, Bohling 5436 (B), see Scholtz (2003).

Italy: Catania, 15 January 2020, S. Brullo s.n. (CAT); Sicily, Catania, 18 February 2020, S. Bogdanović, S. Brullo, G. Tavilla s.n. (CAT); Catania, 03 March 2020, S. Brullo s.n. (CAT); Giarre, 8 March 2020, S. Bogdanović s.n. (CAT).

Libya: Tripolis, garden weed, 2 April 1970, H. Scholz s. n. (B, sub P. annua), see Scholtz (1996).

Morocco: Seeds from herbarium specimen: Morocco, reg.bor.-centralis, Taza, in fossa ad viam, c. 450 m s.m., 1 May 1936, *G. Samuelsson* 7256., 6 July 1938, J. AX. Nannfeldt, 1938: 1 (B 10 0574487; E00381970; E00381971; E00381972; L.1319920); Plantae in horto Botanico Upsaliensi Cultae; Grow from seeds of the type collection: Morocco: reg. bor.-centr.: Taza, "in fossa ad viam", ca. 450 m s.m., 1. May 1936, *G. Samuelsson no.* 7256., May.1938, *J. AX. Nannfeldt s.n.* (M-0103340; DAO000464910; FR0038639); Reg. bor.-occid.: "prope Salè (5 km ad orient.), in ripa stagni exsiccantis", 2 April 1936, *G. Samuelsson* 6266 (S); seeds of this gathering were cultivated by me as 1936:8), see Nannfeldt (1938); ad ripas lacunarum ad orientem urbis Salè, solo arenoso, 2 April 1936, *R. Maire* (MPU), see Nannfeldt (1938); Reg. austro-centr.: Aïn-Gernounch, Zaër, "ruisseaux sur le granit", 11 March 1926, *L. Emberger* (MPU), see Nannfeldt (1938).

Portugal: Alto Alentejo (AAl): Alandroal, 31 March 2009, *F.M. Vázquez & al. s.n.* (HSS 41564), see Vazquez Pardo and Garcia Alonso (2016).

Spain: Prov. Murcia: Cartagena, entre los sambrados de la Huerta de San Antón, 15 February 1902, *F. A. Ibáňez s.n.* (MA 156755, sub *Poa annua*), see Scholz (1968); Prov. Cádiz: in cultis prope Jarez, 6 March 1875, *Perez-Lara s.n.* (MA 11141, sub *Poa annua*), see Scholz (1968); Badajoz (Ba): Calera de León, sierra de Tentudía, zonas altimontanas, 700 msm, 20 February 1997, *F.M. Vázquez s.n.* (HSS 2625), see Vazquez Pardo and Garcia Alonso (2016); Barcellona, L'Hospitalet del Llobregat, Gran Via Sur, 10 April 2014, *Pyke SBP 6902* (BC 940161).

Syria: since loc., 1986?, D. J. Samuel 191 (B), see Scholtz (1996).

Tunisia: Djebel Goraa, on irrigation ditches, 12 April 1968, *H. Scholz* 772 (B, sub *P. annua*), see Scholtz (1996).

Turkey: Muĝla (C1): Bafa-Gölü/Besparmak Daĝi (Latmos-Gebirge), Kaprikiri, Ruinenstätte Herakleia am Latmos, alt. c. 150 m, 17 March 1998, *Kürschner & Parolly 98-26* (B), see Scholtz (1998).

Identification key to the annual species of Poa in the Euro-Mediterranean territory

1a. Stem hypogean, 2–5.5 cm tall, totally covered by leaf sheath; spike simple; spikelet with 1(2)
florets; glumes inconspicuous, up to 0.3 mm long; lemma apex eroded truncateP. cyrenaica
1b. Stem epigean, 5-45 cm tall, 1/2-2/3 covered by leaf sheat (sometime almost totally);
inflorescence in panicle; spikelet with (1)2-6 florets; glumes well developed, 1-3.5 mm long;
lemma apex rounded, acute or obtuse
2a. Stems solitary, geminate or loosely clustered; lower glume 3 nerved; lemma with 3 prominent
nerved (sometimes other 2 evanescent)
2b. Stems densely caespitose, tuffed; lower glume 1 nerved; lemma with 5 prominent nerves 4
3a. Leaf 0.6-1 mm wide; spikelets broadly ovate, with compact florets; upper glume lanceolate-
ovate, 5-nerved; lemma obovate, 2.7–3.5 mm long, with 3 prominent ribs long villous-ciliate and
2 evanescent intermediate ribs glabrous; palea 2.4–2.6 mm long; anthers 0.7–1 mm long;
caryopsis 1.5–1.7 mm longP. jubata
3b. Leaf 1–2 mm wide; spikelets elliptical, with spaced florets; upper glume elliptical, 3-nerved;
lemma oblong-elliptical, 4 mm long, with only 3 prominent ribs scabrous to hairy; palea 4 mm
long; anthers 5 mm long; caryopsis 2.5–2.75 mm longP. sintenisii
4a, Panicle pyramidal to ovoid, with branches spreading to reflexed; spikelets with compact florets
hiding the rachilla
4b. Panicle never pyramidal or ovoid, but with branches erect to ascending; spikelets with spaced
florets not hiding the rachilla
5a. Spikelet with terminal floret (female) smaller than lower ones (hermaphrodite); glumes
subequal; lower glume ovate; upper glume 1.4–1.6 mm long; lemma lanceolate, with hairy
nerves; anthers 1.8–2 mm long
5b. Spikelet with florets subequal (usually all hermaphrodite); glumes unequal; lower glume
lanceolate to ovate-oblong; upper glume 1.8–3 mm long; lemma ovate to oblong, with densely
villous nerves; anthers 0.2–1.3 mm long
6a. Stems with 4–6 nodes; ligule usually rounded, 1 mm long; spikelet 5.5–6.5 mm long; lower
glume 2–3 mm long; upper glume ovate-oblong to lanceolate, 2.5–3 mm long; lemma 2.8–3 mm
long; anthers 0.7–1.3 mm longP. maroccana
6b. Stems with 1–2(3) nodes; ligule ovate-oblong, 1–3 mm long; spikelet 2.8–4.8 mm long, lower
glume 1–1.5 mm long; upper glume elliptical, 1.8–2.5 mm long; lemma 2–2.5 mm long; anthers
0.2–0.5 mm long
- 0

Discussion

According to the literature data (Watson et al. 1992), the genus *Poa* is represented in the Mediterranean territories mainly by perennial specie, with caespitose habit and often provided of rhizomes, stolons or bulbs, while the annual species are not very frequent. Among these latter must be mentioned *P. annua* (cosmopolitan), *P. infirma* (Mediterranean-Irano-Turanian) and *P. maroccana* (Mediterranean), which are closely related among them, while are taxonomically more isolated *P. dimorphantha* (Morocco), *P. sintenisii* (Cyprus). *P. cyrenaica* (Libya) and *Poa jubata* (South-East European), species widely investigated by several authors (see Nannfeldt 1938, Camus 1952, Chrtek and Jiràsek 1962, Scholz 1968, 1993,1996, 2003, Hernandez Cardona 1978, Edmondson 1975, Ibn Tattou 2014, Clayton et al. 2016, Gillespie et al. 2018, Nosov et al. 2019, Tkach et al. 2020). As already highlighted, these species are taxonomically well differentiated and their systematic arrangement is widely supported by phylogenetcc investigations too.

In order to highlight the morphological features that allow to distinguish the aforesaid species from each other and especially *P. maroccana*, it is provided a table where all diacritical characters for their easy identification are listed (Table 1). Besides, an analytical key was processed to be used for their identification.

Based on our results, *P. maroccana* can be considered an autonomous species, morphologically and karyologically well differentiated from the other species belonging to the *P. annua* cycle, which were included in the Sect. *Micrantherae* of the Subgen. *Ochlopoa*, arrangement well supported by recent molecular phylogenetic analyzes too. As concerns its ecology, this species, usually linked to tendentially wet habitats with soils rich in nitrates, allows to its wild populations to spread also in typically synanthropic stands, as for instance the roadsides. Besides, for its habit very similar to that one of *P. annua*, it has often been confused with the latter, this at the expense of knowledge on its real distribution in the Mediterranean territories. It should also be considered that *P. maroccana* often occurs togheter with *P. annua* and *P. infima*, growing mixed in the same habitats, nevertheless it, although closely related to these last two species, never give rise to fertile hybrids, since it was experimentally verified that they are genetically incompatible among them. However, it is to be believed that *P. maroccana* is almost certainly much more widespread than what is known now and that more accurate and extensive investigations, to be carried out both in the field and also in the herbaria, will provide more information on its true distribution.

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Fig. 1. Drawing of *Poa maroccana* from living Sicilian specimens by S. Brullo: A – habit, B – spikelets, C – upper glume dorsal view, D – lower glume dorsal view, E – Lemma dorsal view, F – palea dorsal view, G – palea ventral view, H – stamens, pistil and lodicules, I – Anther, J – Pistil, K – caryopsis, L – ligules.



Fig. 2. General distribution map of Poa maroccana from herbarium and literature data.

						Poa	
Characters	Poa annua	Poa infirma	Poa maroccana	Poa dimorphantha	Poa sintenisii	cyrenaica	Poa jubata
Habit	caespitose, tuffed, many-stemmed	caespitose, tuffed, many- stemmed geniculate, erect	tuffed, many- stemmed	caespitose, clumped, many stemmed	stem solitary to loosely clustered	stem solitary to caespitose	stem solitary to few together
Stem	geniculate, erect, ascending, decumbens, epigean	ascending, decumbens, epigean	erect, ascending, epigean	erect, epigean	erect to ascending. Epigean	erect, hypogean	geniculate, erect, slender
Stem size (cm)	5-30 (45)	5-25 (30) 1/2 to almost	10-40 1/2 to almost	8-25	8-21	2-5.5	12-40 (45)
Stem sheat coverered	2/3 to almost totally	totally	totally	1/2-2/3	1/2-2/3	totally	ca. 2/3
Stem node Leaf sheat length	(1)2-3	1-2 (3)	4-6	3-4	4-5	2-3	usually 3
(cm)	1-6	1.5-4	0.5-4	0.5-3	0,5-3.5	0,5-2.5	2-8.5
Ligule (mm)	0.5-3 (-5)	1-3	1 rounded	2-3	2-3	0,5-1 lanceolate,	2-4(5)
Ligule shape	to truncate, irregularly denticulate margin	obtuse, blunt, erose	rar.triangular- oblong	oblong, obtuse to truncate	lanceolate, lacerate, smooth	lacerate, smooth 10-40 x	lanceolate, acute, smooth
Leaf blade size (mm)	10-100 x 1-5	20-80 x 1-3	15-40 x 1.5-4.5	50-100 x 2-4	12-60 x 1-2	0.5-1	10-60 x 0.6-1
Leaf blade margin	slightly scabrid	smooth to sparsely srabrid	smooth to slightly scabrous	smooth	scabrid	smooth	sparsely scabrid
(cm)	1-7 (10)	2-10	4-9 panicle	4-10	2-11	1-2.5	2-7
Inflorescence shape	panicle erect, open, pyramidal to ovoid	panicie, erect, congested, ovoid-oblong	triangular-ovate to oblong- rhomboidal	panicle lanceolate to oblong	panicle erect,open, ovate	simple spike	panicle erect, open, elllipsoid, pyramidal
branches per node	1-2 (3)	1-3.	1-2	2-4	1-5	1-5	1-2 (3)
Inflorescence primary branches shape Inflorescence branches	spreading to reflexed	ascending	erect to ascending	ascending	ascendig to spreading	erect	ascendig to spreading
indumentum	glabrous	glabrous	glabrous	glabrous	glabrous	glabrous	scabrous

Tab. 1. Distinctive features between the annual Euro-Mediterranean annual species of *Poa*.

Spikelet length (mm)	3-5 (7)	2.8-4.8	5.5-6.5	2.2-3.5	3-4.5	3-4	3.5-6.0
Spikeliet shape	ovate to oblong	ovate to oblong	narrow ovate to oblong-linear	oblong to ovate- lanceolate	elliptical	lax, linear	broadly ovate
Spikelet number florets	2-6. compact florets	(2) 4-6 spaced florets	4-5(6), spaced florets	1-4, spaced florets	2-5, slightly spaced florets	1(2), isolated	4-6 (10), compact florets
Spikelet rachilla	usually not exposed	well exposed	well exposed	well exposed	visible	subequal, inconspicu	not exposed
Glumes Lower glume length	unequal	unequal	unequal	subequal	subequal to unequal	ous	subequal to unequal
(mm)	1.5-2.2	1-1.5	2-3	1-1.4	3	0.0.5-0.3	2.3-3
Lower glume n.ribs	1-nerved	1-nerved	1-nerved	1-nerved	3-nerved	0-1-nerved	3-nerved
Lower glume shape	narrowly lanceolate to ovate, sickle shaped	lanceolate	ovate-oblong to lanceolate	ovate	elliptical	ovate	lanceolate to lanceolate-ovate
Lower glume apex Upper glume length	obtuse	acute to obtuse	subacute	obtuse	acute	obtuse	acute
(mm)	1.5-2.5	1.8-2.5	2.5-3	1.4-1.6	3.5	0.05-0.3	2.5-3.5
Upper glume n.ribs	3-nerved lanceolate to	3-nerved	3-nerved ovate-oblong to	3-nerved	3-nerved	0-1-nerved	5-nerved
Upper glume shape	oblanceolate	elliptic	lanceolate obtuse to	obovate emarginate to	elliptical	ovate	lanceolate-ovate
Upper glume apex	obtuse to acute	acute to obtuse	subacute	obtuse	acute	obtuse	acuminate
Lemma length (mm)	2-3	2-2.5	2.8-3.7	2.2-3	4	3-4 linear- lanceolate,	2.7-3.5
Lemma snape and surface	ovate, glabrous,	glabrous	oblong, glabrous	ent	glabrous	subglabrou s 3	obovate, glabrous
Lemma n.ribs	5, all prominent	5, all prominent	5, all prominent	5, all prominent	3, all prominent	prominent, 2 lateral very short	5, 3 prominent, 2 intermediate evanescent
Lemma keel indumentum	glabrous and hairy in the ribs in lower 1/2	densely villous	densely villous	hairy	scaberulous	villous below	densely and long villous-ciliate on lower 3/5
Lemma lateral ribs indumentum	crisply puberulent to long villous, rr. glabrous crisply puberulent to	densely villous	densely villous	hairy	hairy	glabrous	densely and long villous-ciliate on lower 3/5
ribs indumentum	iong villous, rr. glabrous	densely villous	densely villous	hairy		glabrous	glabrous

Lemma apex	obtuse to acute	rounded	rounded to rounded-obtuse	obtuse	acute to apiculate	erose, truncate	rounded
Palea length (mm)	2-2.4	1.7-2.3	2.3-3	2.2-3.2	4	3-4	2.4-2.6
Palea keels indumentum	shortly to long villous, along all keels	long villous, along all keels	long villous, along all keels	long ciliate in lower half	long villous, along all keels	hairy along the keels well	scabrous to shortly hairy and glabrous below
Palea flanges	well developed and not appressed	well developed and not appressed	well developed and not appressed	well developed and not appressed	well developed and not appressed	developed and not appressed absent (rar.	absent or very narrow and appressed
Lodicules length (mm)	0.45-0.5 broadly lanceolate to	0.3 mm lanceolate,	0.3-0.4	0.2 obovate-		present)	0.5 mm
Lodicules shape	ovate, lobed	lobed	pyriform	cuneiform, retuse	ovate, lobate, acute		lanceolate, unlobed
Anther length (mm) Caryopsis length	0.6-1.1 (1.3)	0.2-0.5	0.7-1.3	1.8-2	0.5	2	0.7-1
(mm)	1.5-2.3	1.1-1.4 ellipsoid,	1-1.4	0.9-1	2.5-2.75	1.4-2.5	1.5-1.7
	ellipsoid, circular-	circular-	fusiform,subtrigo	oblong,		oblong,	
Caryopsis shape	compressed in cross section	compressed in cross section	nous in cross section	semicircular in cross section	fusiform, sulcate on hilar side	compresse d laterally	fusiform, trigonus in cross section