

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

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**Abstract** – *Poa maroccana* is an annual Mediterranean species, which is recorded for the first time from Sicily and for the entire territory of Italy. It usually occurs in synanthropic 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, specifically 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 having 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 in 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 other annual species of this genus occurring in the Mediterranean, a careful morphological description and an iconography are provided, as well as a comparative morphological table of all allied species and also an analytical key for their 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 Jiršek, 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 the literature as clearly 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 and Soreng 2005, Gillespie et al. 2007, Cabi et al. 2017, Tkach et al. 2020). As concerns *P. maroccana*, it often has been treated as a doubtful taxon (cf. Edmondson 1980, Valdés et al. 2002, Strid 2016) or not quoted at all (cf. Ortega-Olivencia and Devesa 2018). In view of the large amount of literature data (Nannfeldt 1938, de Litardière 1938, 1939, Camus 1952, Tutin 1957, Chrtek and Jiršek 1962, Scholz 1968, 1993, 1996, Böhling and Scholz 2003, Valdés and Scholz 2006, 2009, Valdés 2013, Dimopoulos et al. 2013, Ibn Tattou 2014, Nosov et al. 2019), *P. maroccana*

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must be conversely considered a species morphologically clearly 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 plants using seeds taken from these specimens. Besides, this author emphasized the close relationships of *P. maroccana* with *P. infirma*, with which it shares loosely arranged and strongly compressed culms, lower inflorescence branches erect-patent after anthesis, spikelets with remote flowers not hiding the rachilla, apical flower not longer 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 shown by Nannfeldt (1938) and de Litardière (1938, 1939). Another species quite similar to *P. maroccana* is *P. annua*, which is also tetraploid with  $2n = 28$ , and yet shows 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 has greater similarities with *P. maroccana*, especially with respect to the lemma nerves being provided with long hairs (Scholz 1968). In particular, *P. annua*, which on a superficial observation could be confused with *P. maroccana*, differs very clearly from the latter because of its slightly compressed, often creeping, roots of the culms, the 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. *ranglumis* Fröhner) or sparsely hairy, anthers lightly shorter (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*, an origin previously hypothesized by Chrtek and Jiršek (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 chromosome count ( $2n = 28$ ) and were completely sterile (Chrtek and Jiršek 1962, Warwick 1979). Triploid hybrids ( $2n = 21$ ) originating from a cross 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 have low fertility (see

Nannfeldt 1938, Scholz 1993). Basing of these results, it can therefore be asserted that *P. maroccana* from the morphological, caryological and molecular viewpoint must be considered a species taxonomically distinct from other taxa belonging to the cycle of *P. annua*, having clear phylogenetic correlations only with *P. infirma*.

As concerns its taxonomic arrangement, *P. maroccana* falls within the *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 Valdés and Scholz (2006) considered it more appropriate to arrange 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, Soreng 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 *Poa* must include 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) it is necessary to place within *Poa* both *Lindbergella sintenisii* (H. Lindb.) Bor, described by Lindberg (1942) as *P. sintenisii* and later included by Bor (1968, 1969) in the monospecific genus *Lindbergella*, accepted in the literature as an endemic from Cyprus (Meikle 1985, Watson et al. 1992, Soreng et al. 2015) and *Libyella cyrenaica* (Durand & Barratte) Pamp., also initially attributed by Durand and Barratte (1910) to the genus *Poa*, but recognized by Pampanini (1925) as a taxonomically isolated species and referred to a new genus endemic from Cyrenaica, named *Libyella*, a treatment recognized by later authors (Maire 1953, Sherif and Siddiqi 1988, Watson et al. 1992, Soreng et al. 2015). Recently, Gillespie et al. (2018) and Tkach et al. (2020) also arranged within *Poa* 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 phylogenetic studies. They are the following:

***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; *Lindbergella* 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. Bi-

ol. 81:35, 1976; *Tovarochoa* 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. Landschafts-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 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 sect. *Micrantherae* Stapf (= sect. *Ochlopoa* Asch. & Graeb.), while *P. sintenisii* is arranged in sect. *Linbergella* (Bor) Soreng, Cabi & L.J. Gillespie of the subgen. *Pseudopoa*. Finally, *P. jubata* was referred by Cabi et al. (2017) to sect. *Jubatae*, a monotypic section whose attribution to a distinct subgenus is currently uncertain (cf. Brullo et al. 2019). According to 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 are the positions of the numerous annual *Poa* species of East Asia, since some of them seem to have a hybridogenic origin among the taxa of sect. *Homalopoa* and those of *Stenopoa*, that do not allow them to be referred clearly to subgen. *Poa* or to 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 *P. maroccana* must also now be added. As already pointed out, this species, showing a markedly thermophilous character, probably has an underestimated Mediterranean distribution. This 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 of the Italian terri-

tory. 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 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 careful investigations could certainly expand its current distribution.

## Materials and methods

The morphological analysis of *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* the morphological description, drawings and keys provided by Nannfeldt (1938), Camus (1952), Chrtek and Jiràsek (1962), Scholz (1996) and Brullo et al. (2019) were used.

As concerns the processing of the morphological data listed in Table 1, it was based on the 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, Zhu 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!).

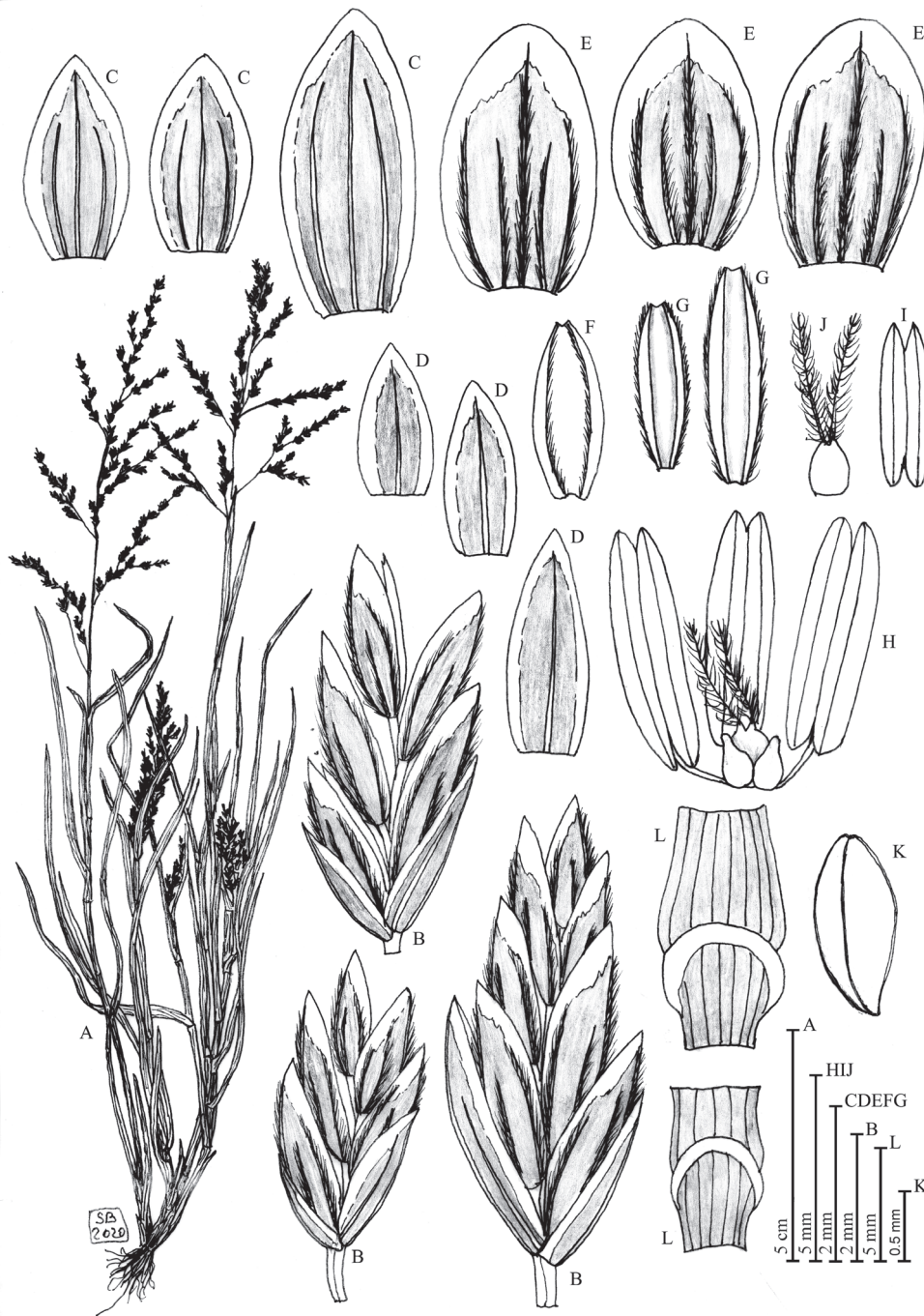
Synonyms – *Poa annua* L. var. *maroccana* (Nannf.) Litard., *Rev. Cytol. et Cytophysiol. Végét.*, 4: 83, 1939; *Ochlopoa maroccana* H.Scholz in Böhling, & H. Scholz, *Ber. Inst. Landschafts-Pflanzenökologie Univ. Hohenheim, Beih.* 16: 59, 2003.

Description (from Sicilian material) – Annual, glabrous, without rhizomes, tufted, many-stemmed, with intravaginal branching. Culms 10–40 cm tall, erect or weakly geniculate at base, glabrous, with 4–6 nodes. Leaves 4–6, with sheath 5–40 mm long, fused up to 1/3, stem covered one half or up 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, gla-

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

<i>Characters</i>	<i>Poa annua</i>	<i>Poa infirma</i>	<i>Poa maroccana</i>	<i>Poa dimorphantha</i>	<i>Poa sintenisii</i>	<i>Poa cyrenaica</i>	<i>Poa jubata</i>
Habit	caespitose, tufted, many-stemmed	caespitose, tufted, many-stemmed	tufted, 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	geniculate, erect, ascending, decumbens, epigean	geniculate, erect, ascending, epigean	erect, epigean	erect to ascending, Epigean	erect, hypogean	geniculate, erect, slender
Stem size (cm)	5-30 (45)	5-25 (30)	10-40	8-25	8-21	2-5.5	12-40 (45)
Stem sheath covered	2/3 to almost totally	1/2 to almost totally	1/2 to almost totally	1/2-2/3	1/2-2/3	totally	ca. 2/3
Stem node	(1)2-3	1-2 (3)	4-6	3-4	4-5	2-3	usually 3
Leaf sheath length (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	2-3	2-3	0.5-1	2-4(5)
Ligule shape	ovate-oblong, obtuse to truncate, irregularly denticulate margin	ovate-oblong, obtuse, blunt, erose	rounded, rar. triangular-oblong	oblong, obtuse to truncate	lanceolate, lacerate, smooth	lanceolate, truncate, lacerate, smooth	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	10-40 x 0.5-1	10-60 x 0.6-1
Leaf blade margin	slightly scabrid	smooth to sparsely scabrid	smooth to slightly scabrous	smooth	scabrid	smooth	sparsely scabrid
Inflorescence size (cm)	1-7 (10)	2-10	4-9	4-10	2-11	1-2.5	2-7
Inflorescence shape	panicle erect, open, pyramidal to ovoid	panicle, erect, congested, ovoid-oblong	panicle triangular-ovate to oblong-rhomboidal	panicle lanceolate to oblong	panicle erect, open, ovate	simple spike	panicle erect, open, ellipsoid, pyramidal
Inflorescence branches per node	1-2 (3)	1-3.	1-2	2-4	1-5	1-5	1-2 (3)
Inflorescence primary branches shape	spreading to reflexed	ascending	erect to ascending	ascending	ascending to spreading	erect	ascending to spreading
Inflorescence branches indumentum	glabrous	glabrous	glabrous	glabrous	glabrous	glabrous	scabrous
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
Spikelet 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	.	not exposed
Glumes	unequal	unequal	unequal	subequal	subequal to unequal	subequal, inconspicuous	subequal to unequal
Lower glume length (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

<i>Characters</i>	<i>Poa annua</i>	<i>Poa infirma</i>	<i>Poa maroccana</i>	<i>Poa dimorphantha</i>	<i>Poa sintenisii</i>	<i>Poa cyrenaica</i>	<i>Poa jubata</i>
Lower glume apex	obtuse	acute to obtuse	subacute	obtuse	acute	obtuse	acute
Upper glume length (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	3-nerved	3-nerved	3-nerved	3-nerved	0-1-nerved	5-nerved
Upper glume shape	lanceolate to oblanceolate	elliptic	ovate-oblong to lanceolate	obovate	elliptical	ovate	lanceolate-ovate
Upper glume apex	obtuse to acute	acute to obtuse	obtuse to subacute	emarginate to obtuse	acute	obtuse	acuminate
Lemma length (mm)	2-3	2-2.5	2.8-3.7	2.2-3	4	3-4	2.7-3.5
Lemma shape and surface	broadly lanceolate to ovate, glabrous,	ovate to oblong, glabrous	ovate to ovate oblong, glabrous	lanceolate, pubescent	oblong-elliptical, glabrous	linear-lanceolate, subglabrous	obovate, glabrous
Lemma n.ribs	5, all prominent	5, all prominent	5, all prominent	5, all prominent	3, all prominent	3 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	densely villous	densely villous	hairy	hairy	glabrous	densely and long villous-ciliate on lower 3/5
Lemma intermediate ribs indumentum	crisply puberulent to long 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	scabrous to shortly hairy and glabrous below
Palea flanges	well developed and not appressed	well developed and appressed	well developed and not appressed	well developed and not appressed	well developed and not appressed	well developed and not appressed	absent or very narrow and appressed
Lodicules length (mm)	0.45-0.5	0.3 mm	0.3-0.4	0.2	.	absent (rar. present)	0.5 mm
Lodicules shape	broadly lanceolate to ovate, lobed	lanceolate, lobed	pyriform	obovate-cuneiform, retuse	ovate, lobate, acute	.	lanceolate, unlobed
Anther length (mm)	0.6-1.1 (1.3)	0.2-0.5	0.7-1.3	1.8-2	0.5	2	0.7-1
Caryopsis length (mm)	1.5-2.3	1.1-1.4	1-1.4	0.9-1	2.5-2.75	1.4-2.5	1.5-1.7
Caryopsis shape	ellipsoid, circular-compressed in cross section	ellipsoid, circular-compressed in cross section	fusiform, subtrigonus in cross section	oblong, semicircular in cross section	fusiform, sulcate on hilar side	oblong, compressed laterally	fusiform, trigonus in cross section



**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.

brous. 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 clearly distinct nerves, all densely villous and not reaching the margin. Palea hyaline, 2.3–3 mm long, with keels villous

throughout their length, shortly ciliate 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, subtrigonus in cross section, hilum inconspicuous. Flowering time is from January to April.

**Karyology** – According to the literature (Nannfeldt 1938, de 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 between *P. infirma* and *P. supina* (Tutin 1957), *P. maroccana* is an autotetraploid originating from *P. infirma* as hypothesized by Edmondson (1980), Chrtek and Jirásek (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 roadsides, 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, the latter also representing the first record for the

Italian flora as a whole. As previously highlighted by Scholz (1993), *P. maroccana* is most likely more widespread than it might seem based on current information due mainly to former misidentifications, as it has already been ascertained by examination of 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 at 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); Dép. Alger: Teniet-el-Had, 25 April 1889, *Mac-Carthy (?) 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 Territoires 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).



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

**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, Mavroja, 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); Fokidos, O Itea, 05 April 2011, *Willing R., Willing E. 205661* (B 10 0403178); Fokidos, 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 (1996); Crete., olive-tree plantation near K. Karouzana N of Kasteli, 17 April 1994, *H. Scholz s. n.* (B), see Scholz (1996); Crete., potato field and irrigation ditches in the hinterland of the beach near Malia, 22 April 1994, *H. Scholz s. n.* (B), see Scholz (1996); Crete distr. Lasithi: Lasithi Plateau, near Pinakiano, fallow land, with *P. infirma*, 15 April 1994, *H. Scholz s. n.* (B), see Scholz (1996); Crete, Nom. Lasithiou, Ep. Lasithiou: Lasithi plain, SE of Kristallenia monastery, 840 m, large level ploughed field, 4500 m<sup>2</sup>, many similar fields and orchards in the 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, *Scholz s.n.* (B), see Scholz (2003); Crete, Lasithiou, Ep. Ierapetras, Thripti, weedy vineyard, 700 m alt., 24 March 1998, *Bohling, Raus 7218* (B), see Scholz (2003); Crete, Ep. Lasithiou, Ag. Kroustalienias, open weed vegetation on seasonally wet field, 820 m a.s.l., 1 May 1997, *Bohling 5436* (B), see Scholz (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, 3 March 2020, *S. Brullo s.n.* (CAT); Giarre, 8 March 2020, *S. Bogdanović s.n.* (CAT).

**Libya:** Tripoli, garden weed, 2 April 1970, *H. Scholz s. n.* (B, sub *P. annua*), see Scholz (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 Upsalien-si 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); Casablanca, endroits frais incultes ou cultivés, 13 January 1918, *L. Duceillier* (MPU), see Nannfeldt (1938); Reg. austro-centr.: Ain-Gernouch, Zaër, “ruisseaux sur le granit”, 11 March 1926, *L. Emberger* (MPU), see Nannfeldt (1938).

**Portugal:** Alto Alentejo (AAI): 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. Ibáñez 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 Scholz (1996).

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

**Turkey:** Muğla (C1): Bafa-Gölü/Besparmak Dağı (Lattos-Gebirge), Kaprikiri, Ruinenstätte Herakleia am Lattos, alt. c. 150 m, 17 March 1998, *Kürschner & Parolly 98-26* (B), see Scholz (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 truncate ..... *P. cyrenaica*
- 1b. Stem epigeal, 5–45 cm tall, 1/2-2/3 covered by leaf sheath (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 ..... 2
- 2a. Stems solitary, geminate or loosely clustered; lower glume 3 nerved; lemma with 3 prominent nerved (sometimes other 2 evanescent) ..... 3
- 2b. Stems densely caespitose, tufted; 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 long ..... *P. 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 long ..... *P. sintenisii*



- 4a. Panicle pyramidal to ovoid, with branches spreading to reflexed; spikelets with compact florets hiding the rachilla ..... *P. annua*
- 4b. Panicle never pyramidal or ovoid, but with branches erect to ascending; spikelets with spaced florets not hiding the rachilla ..... 5
- 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 .....  
..... *P. dimorphantha*
- 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 ..... 6
- 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 long ..  
..... *P. 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 ..... *P. infirma*

## Discussion

According to the literature data (Watson et al. 1992), the genus *Poa* is represented in the Mediterranean territories mainly by perennial species, with caespitose habit and often provided with rhizomes, stolons or bulbs, while the annual species are not very frequent. Among these latter the following must be mentioned: *P. annua* (cosmopolitan), *P. infirma* (Mediterranean-Irano-Turanian) and *P. maroccana* (Mediterranean), which are closely related among them, while taxonomically more isolated are *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 Jirásek 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 phylogenetic investigations.

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

Based on our results, *P. maroccana* can be considered an autonomous species, morphologically and karyologically clearly differentiated from the other species belonging to the *P. annua* cycle, which were included in the sect. *Micran-*

*therae* of a subgen. *Ochlopoa*, arrangement well supported by recent molecular phylogenetic analyses too. With respect to its ecology, this species, usually linked to wet habitats with soils rich in nitrates, allows its wild populations to spread also in typically synanthropic stands, as for instance the roadsides. Besides, because its habit is very similar to that 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 together with *P. annua* and *P. infirma*, growing mixed in the same habitats; nevertheless, although closely related to these last two species, it never gives rise to fertile hybrids, was and it has been experimentally verified that they are genetically incompatible. However, it is to be believed that *P. maroccana* is almost certainly much more widespread than is currently known 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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