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Artikel: Studies within the genus Digitaria Haller (Poaceae, Panicoideae) in southwestern Europe

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Studies within the genus Digitaria Haller (Poaceae, Panicoideae) in southwestern Europe

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Abstract

VERLOOVE, F. (2008). Studies within the genus Digitaria Haller (Poaceae, Panicoideae) in southwestern Europe. *Candollea* 63: 227-233. In English, English and French abstracts.

Herbarium revisions and recent fieldwork in France and Italy yielded several interesting new data about the grass genus *Digitaria* Haller *(Poaceae, Panicoideae)*. The historical presence of *Digitaria debilis* (Desf.) Willd. in continental France is finally confirmed. *Digitaria radicosa* (C. Presl) Miq. is reported for the first time from Europe (ephemeral alien in Corse) and *Digitaria violascens* Link is an overlooked, recently naturalized xenophyte in France and Italy. Diagnostic characteristics of *Digitaria ischaemum* (Schweigg.) Muhl. and *Digitaria violascens* are discussed. Drawings and an identification key for the species of *Digitaria* in southwestern Europe are provided.

Key-words

POACEAE – *Digitaria* – Taxonomy

Résumé

VERLOOVE, F. (2008). Etudes sur le genre Digitaria Haller (Poaceae: Panicoideae) dans le sud-ouest de l'Europe. *Candollea* 63: 227-233. En anglais, résumés anglais et français.

La révision de plusieurs herbiers et des recherches de terrain en France et en Italie ont fourni plusieurs données intéressantes concernant le genre *Digitaria* Haller *(Poaceae, Panicoideae)*. La présence historique en France continentale de *Digitaria debilis* (Desf.) Willd. est confirmée. La présence de *Digitaria radicosa* (C. Presl) Miq. est rapportée pour la première fois en Europe (adventice éphémère en Corse) et *Digitaria violascens* Link est une xénophyte méconnue, récemment naturalisée en France et en Italie. Les caractères discriminatifs de *Digitaria ischaemum* (Schweigg.) Muhl. et *Digitaria violascens* sont discutés. Des dessins et une clé pour la détermination des espèces du genre *Digitaria* dans le sud-ouest de l'Europe sont présentés.

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Introduction

Despite the existence of a world monograph (HENRARD, 1950) and numerous subsequently published, often relatively recent local treatments (see for instance, BOR, 1960; VELDKAMP, 1973; CLAYTON & RENVOIZE, 1982; WEBSTER, 1983; WIPFF, 2003; SHOULIANG & PHILLIPS, 2006), *Digitaria* Haller remains a surprisingly taxonomically difficult grass genus. Specific boundaries, even between economically important species like *Digitaria ciliaris* (Retz.) Koeler, *D. ischaemum* (Schreb.) Muhl., *D. sanguinalis* (L.) Scop. or *D. violascens* Link, are still insufficiently understood and the misinterpretation or even inversion of diagnostic characteristics used by many authors adds to the confusion.

Southwestern Europe has a very limited number of native species *(D. debilis* (Desf.) Willd., *D. ischaemum* and *D. sanguinalis).* In the past decades however some non-native taxa have become naturalized locally *(D. aequiglumis* (Hack. & Arechav.) Parodi, *D. ciliaris*, *D. violascens).* Up to now these species are poorly known or simply overlooked in southwestern Europe.

The present paper discusses the morphological differences, especially difference in spikelets (see Fig. 1A-G), among some species of *Digitaria* and provides identification aids (keys) for a better understanding. This study is solely based on field trips in northwestern Italy (September 2004) and southern France (September 2006) and a concise study of herbarium specimens at the National Botanic Garden of Belgium (BR), the University of Gent, Belgium (GENT), the University of Liège, Belgium (LG), and the private herbarium of the author. Christophe Girod and Jean-Marc Tison provided additional collections of *D. violascens* from France. An overall revision of the concerned taxa, although time-consuming, is needed for a better understanding of these species. The information offered in the present paper can be used as a guide until a more detailed study is completed.

Taxonomic treatment

1. *Digitaria debilis* (Desf.) Willd., Enum. Pl.: 91. 1809, (Fig. 1A).

Specimens examined. – **FRANCE. Dépt Gironde:** Lamothe [doubtlessly Lamothe-Landerron, close to the border of the department Lot-et-Garonne], sables humides, 14.IX.1899, *Durieu de Maisonneuve s.n.* (LG; sub "*D. filiformis* Koel.").

Notes. – *Digitaria debilis* is a native of subtropical and warm temperate areas in Africa and the western Mediterranean (type described from La Calle, Algeria). According to CLAYTON (1980), its presumed native European distribution area covers parts of Italy, Portugal and Spain. The exact status of *D. debilis* in at least parts of Europe remains doubtful. It was, for instance, recently considered as a xenophyte rather than an autochthonous species in Spain (SANZ ELORZA & al., 2004). Likewise, NATALI & JEANMONOD (1996) seriously doubt its native status in Corse. This species also covers parts of Italy, Portugal, and Spain. Subsequently, *D. debilis* was recorded from Corse as an overlooked native species (CONRAD & DESCHÂTRES, 1983). From continental France, *D. debilis* has been mentioned on various occasions. According to KERGUÉLEN (1975), this species might be naturalized in SW of France (in Orthez, Pyrénées-Atlantiques) and elsewhere. *Digitaria aequiglumis* a South American species, is morphologically similar to *D. debilis* (VIVANT, 1980) (see Fig. 1B and 1A). An old collection of presumed *D. debilis* from the 19th century from Orthez, preserved at P, is very meagre but apparently also belongs to *D. aequiglumis* (KERGUÉLEN, 1983). As a consequence, CLAYTON (1980) finally wrote: "An old record from S.W. France has never been confirmed".

The above record – although erroneously identified by the finder – unequivocally confirms the historical presence of *D. debilis* in southwestern France. Moreover, the species used to be found in an area where at present *D. aequiglumis* is a largely naturalized and a fast spreading xenophyte (VERLOOVE, 2000; ANIOTSBÉHÈRE & DUSSAUSSOIS, 2003). Hence, it cannot be totally excluded that *D. debilis* is still present but misidentified as *D. aequiglumis*.

2. *Digitaria radicosa* (J. Presl) Miq., Fl. Ned. Ind. 3: 437. 1857 (Fig. 1C, 2).

Specimens examined. – **FRANCE. Dépt Corse-du-Sud:** Sainte-Lucie de Porto-Vecchio, lieu-dit Olmuccio, forêt alluviale à tamaris (holocène, argile), 10.IX.1969, *Coûteaux, M. 69 Co 54* (BR, sub *"Digitaria* spec.").

Notes. – *Digitaria radicosa* is largely distributed in the Old World (sub-) tropics. It is a prevalent weed in many parts of Asia (see for instance HÄFLIGER & SCHOLZ, 1980). With its very narrow spikelets it resembles *D. aequiglumis* in general habit and, to some extent, *D. debilis* (both known from France, see above) (see Fig. 1C and 1A). However, *D. radicosa* can be immediately distinguished by much smaller upper glumes (in the specimen here concerned only 1/3 as long as the lower lemma). This species is morphologically similar to *D. ciliaris* (see Fig. 1D) and *D. sanguinalis* (L.) Scop. (see Fig. 1E). *Digitaria setigera* Roth appears to be morphologically the most similar species in the tropics and both are less easily distinguished than frequently admitted. As a matter of fact many diagnostic characteristics are unreliable, often intermixed or contradictory. In general, *D. radicosa* is a more slender species with few inflorescence branches (2-3 in the specimen from Corse), almost smooth inflorescence axes (not densely scabrous), slightly longer lower and upper glumes, and less hairy pulvini.

The present collection from Sainte-Lucie de Porto-Vecchio appears to be the first and only European record. Therefore, *D. radicosa* should be considered a casual (ephemeral) alien.

3. *Digitaria violascens* Link, Hort. Berol. 1: 229. 1827 (Fig. 1E).

Specimens examined. – **France. Dépt Alpes-Maritimes:** Sophia-Antipolis, pelouse du stade. IX.1995, *Jauzein, P. s.n.* (priv. herb. F. Verloove, dupl. LG). **Dépt Hérault:** Montpellier, Parc de Grammont, pelouse, 21.IX.2002, comm. J. Molina; La Grande Motte towards Le Grau-du-Roi, RD 255, lawn, 13.IX.2006, *Verloove, F. 6618* (priv. herb. F. Verloove); Le Grau-du-Roi, Port Camargue, Plage Nord, lawn near the sea, 15.IX.2006, *Verloove, F. s.n.* (priv. herb. F. Verloove); Montpellier (quartier Saint Clément), campus de l'ENSAM, pelouses, 27.10.2006, *Girod, C. s.n.* (priv. herb. C. Girod, dupl. priv. herb. F. Verloove).

Italy. Prov. Novara: Galliate, ponte Turbigo, left of river Ticino, stony border of new canal, common, 06.IX.2004, *Verloove, F. 5763* (priv. herb. F. Verloove, dupl. LG); Cameri, Le Casette, left bank of river Ticino, gravelly border of river, 10.IX.2004, *Verloove, F. 5770* (LG).

Notes. – *Digitaria violascens* is native in tropical Asia (and probably also tropical America from where the type was described) but has steadily expanded its distributional area to other tropical and warm-temperate areas in more recent times (Africa, Australia, North America). It has been declared a noxious weed in the subtropics (Holm & al., 1979; Häfliger & Scholz, 1980). *Digitaria violascens* is morphologically similar to the warm-temperate *D. ischaemum* (see Fig. 1F and 1G). Both are annuals, have relatively small spikelets in groups of three on the rachis, and dark brown to black upper lemmas at maturity. Despite their close resemblance, they are usually distinguished without difficulty in most floras. Few taxonomists drew the attention to the often blurred boundaries between *D. ischaemum* and *D. violascens* (see for instance Cope, 1982). On the sole basis of spikelet indumentum, *D. violascens* and *D. ischaemum* were accommodated in two different sections by Henrard (1950), *Digitaria* sect. *Verrucipilae* (Stapf) Henrard and sect. *Clavipilae* (Stapf) Henrard, respectively.

Henrard (1950) characterized *Digitaria* sect. *Verrucipilae* as having spikelet hairs "very conspicuously and characteristically verrucose, that is, the hairs not smooth walled, straight, waved or contorted, always very fine and provided with superficial, irregular prominent little warts, as if sprinkled with fine grains of sand, when examined under a very strong lens or under the microscope". He then characterized *Digitaria* sect. *Clavipilae* as having spikelet hairs "often appressed, of different length; the shorter ones more or less abruptly, the longer ones more gradually passing into a rounded, very distinct, obtuse, ovate or obovate, contrasting globular head, which is much broader than the diameter of the hair and much shorter too, giving its summit a clavate appearance, the hairs finally forming a delicate often furfuraceous indumentum". The spikelet indumentum of both sections, examined in young spikelets as they often become glabrous with age, especially in *D. violascens*, is very delicate, and only visible under high magnification and hence not a practical identification feature. Moreover, the pubescence as described above is not exclusive to either sections. Veldkamp (1973) already showed that in *D. ischaemum* hairs are always verrucose, usually acute and curled or twisted at the end, and occasionally clavate (see also Cope, 1982). He failed to see sharp distinctions between the hair types and argued that a reassessment of the sections would be warranted. Therefore, most present-day taxonomists no longer follow Henrard's point of view. *Digitaria ischaemum* and *D. violascens* are usually accommodated in the *Digitaria* sect. *Ischaemum* Ohwi, although at least one diagnostic character of *D. ischaemum* and *D. violascens* (spikelets ternate) conflicts with Ohwi's description of his new *Digitaria* sect. *Ischaemum* (Ohwi, 1942) in which spikelet indumentum can be either verrucose or relatively smooth with a dilated apex (see for instance, Veldkamp, 1973; Webster, 1983; Tsvelev, 1984: 569-1196; Giraldo-Cañas, 2005). However, as a rule, mixed pubescence only occurs in *D. ischaemum;* in *D. violascens* the hairs with clavate apices are always lacking and spikelet indumentum is often less prominent or even virtually absent. In short, the distinction between both taxa on the basis of spikelet indumentum is usually only possible under high magnification but troublesome or even impossible in the field (see Fig. 1F and Fig. 1G).

Spikelet length is perhaps the most frequently used (and often even single; see for instance Hitchcock, 1936; Gould, 1979; Noltie, 2000) diagnostic feature to distinguish between both taxa in modern floras. *Digitaria ischaemum* is usually characterized by spikelets well over 2 mm long whereas *D. violascens* has spikelets well below 2 mm long. In many cases this surely holds true but spikelet length is an extremely variable character. There is a wide overlap and, in practice, there appears to be a continuous series of intermediates. Veldkamp (1973) already figured out that *D. violascens* is a heterogeneous species with two more or less different morphotypes: a small-spikeleted form with spikelets (1.2-)1.3-1.6 mm long and a larger-spikeleted form (including the typus!) with spikelets (1.6-)1.7-2(-2.5) mm long. The spikelet length of the latter form agrees perfectly with typical *D. ischaemum* and, spikelets of *D. violascens* can be even longer than those of *D. ischaemum*. Spikelet length can be used to distinguish between small-spikeleted forms of *D. violascens* and *D. ischaemum* but when large-spikeleted forms of the former are encountered then one cannot separate these two species with confidence. The populations currently found in southwestern Europe, at least those seen so far, apparently belong

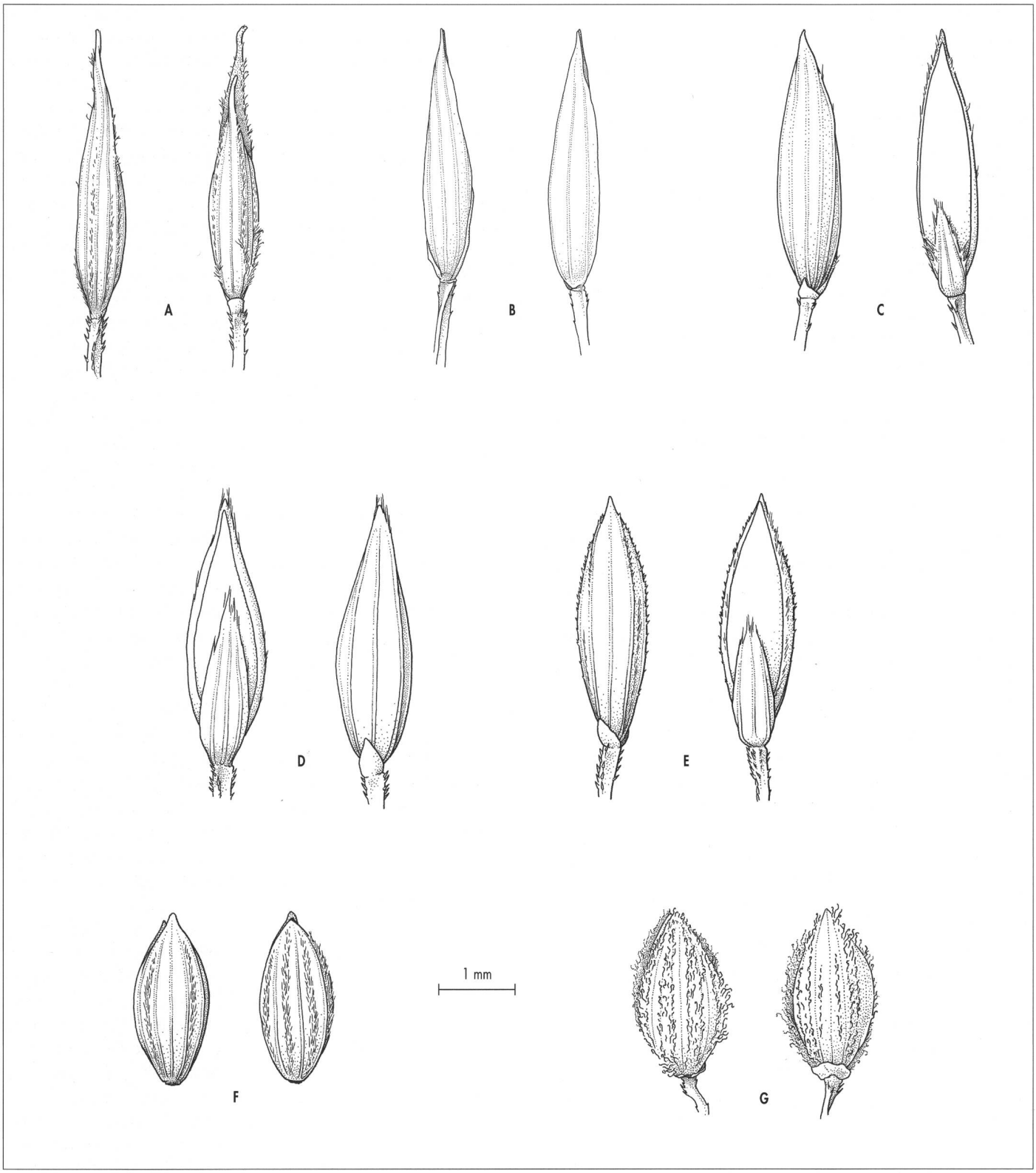

Fig. 1. – Spikelets of species of *Digitaria* Haller in southwestern Europe (front and back side). **A.** *D. debilis* (Desf.) Willd. **B.** *D. aequiglumis* (Hack. & Arechav.) Parodi. **C.** *D. radicosa* (J. Presl) Miq. **D.** *D. ciliaris* (Retz.) Koeler. **E.** *D. sanguinalis* (L.) Scop. **F.** *D. violascens* Link. **G.** *D. ischaemum* (Schweigg.) Muhl.

[Drawn by Sven Bellanger]

Fig. 2. – Habitus of *Digitaria radicosa* (C. Presl) Miq.
[Drawn by Sven Bellanger]

to the large-spikeleted form. Plants from France usually have spikelets 1.8-2 mm long, whereas those from Italy are characterized by spikelets up to 2.1 mm long. As a result, the European populations of *D. violascens* can hardly be distinguished from *D. ischaemum* on the sole basis of spikelet length (see Fig. 1F and Fig. 1G).

Inflorescence form provides various characters in which to differentiate these species: number of racemes per inflorescence, length of the common axis, and position of the racemes on the axis at or after anthesis. Generally, *D. ischaemum* has fewer racemes on a more elongated common axis. Moreover, the racemes, especially the lowermost raceme, are soon spreading horizontally (see also NOLTIE, 2000; SHOULIANG & PHILLIPS, 2006). In *D. violascens*, racemes are often more numerous, (sub-)digitate (without or with a very short common axis) and racemes usually remain erect to ascending at anthesis (but outside southwestern Europe inflorescences with only two racemes, finally curved out after anthesis are also encountered). In general, racemes are often longer and more slender in *D. violascens.*

As a result of this particular combination of features the general habit of both species is usually different. The habit in general and the inflorescence form of French and Italian populations of *D. violascens* are not much alike either. The compact, prostrate growth form with few, short racemes of French populations is probably induced by environmental conditions because all populations are confined to lawns that are regularly mowed (see below).

Number of veins of upper glume and lower lemma is a useful feature according to some authors (see TSVELEV, 1984) but, again, numbers vary considerably from one author to another and are often contradictory. From our experience the upper glumes appear to be 3-nerved in *D. violascens.* Moreover, since the spikelets are usually less hairy to glabrous, the veins are often more pronounced. *Digitaria ischaemum* sometimes has two additional nerves. The lower lemmas of *D. violascens* usually have seven equidistant nerves whereas in *D. ischaemum* there are five unequidistant lemmatal nerves.

The presence or absence of spicules on the pedicels is a diagnostic feature according to HENRARD (1950): pedicels are smooth in *D. ischaemum* and scabrous in *D. violascens.* According to most floras pedicels are scabrous in both species. This characteristic is not reliable since pedicels can be either smooth or scabrous in *D. violascens* and *D. ischaemum* and can even vary on a single specimen.

The following characteristics are extremely variable and thus not useful for differentiating these two species: absence or presence of a lower glume (see TSVELEV, 1984), the length and width of the upper glumes (see GLEASON & CRONQUIST, 1968). The average measurements are identical for both species (WEBSTER, 1983), the width and length of the leaf blades (see

NOLTIE, 2000), the presence or absence of axillary inflorescences (see WEBSTER, 1983; WIPFF, 2003) and the veins of upper glumes anastomosing or not (see RÚGOLO DE AGRASAR, 1974).

Spikelet indumentum seems to be the best characteristic to use to separate *D. violascens* from *D. ischaemum*. Apparently, these two species were once geographically isolated, *D. ischaemum* being restricted to warm-temperate climates and *D. violascens* found primarily in tropical areas. Both species co-exist today and much of their current distribution patterns might be human mediated. Subsequently, introgression might have further blurred the specific boundaries between these two species. The retention of *D. violascens* at specific level has come into question. RADFORD (1964) was possibly correct in recognizing these at the varietal rank as *D. ischaemum* var. *violascens* (Link) Radford.

Digitaria violascens is also morphologically similar to *D. longiflora* (Retz.) Pers. (see for instance CLAYTON & RENVOIZE, 1982), a native of the Old World (sub-)tropics. JAUZEIN (1992) erroneously ascribed the first French record to this species. *Digitaria longiflora* can be distinguished from *D. ischaemum* and *D. violascens* by having stolons, only two racemes, and pale upper lemmas (pale brown to pale gray, becoming light brown at maturity).

At least in France *D. ischaemum* and *D. violascens* are found in quite different ecological circumstances. The former is a native, widely distributed agricultural weed (although much rarer in the south), usually confined to sandy arable land whilst the non-native *D. violascens* is, at least at present, only known as a lawn weed in more favourable locations in the south. *Digitaria violascens* appears to be a widely overlooked lawn weed in southern France and probably elsewhere in southern Europe. Near Montpellier (dépt Hérault), several localities were found in the autumn of 2006, all in frequently mowed lawns. It is unclear whether *D. violascens* was unintentionally introduced as a contaminant in foreign grass seed or if it was introduced through other vectors and subsequently found a suitable habitat in lawns.

In Italy, *D. violascens* occupies quite different habitats. It was detected in abundance as a ruderal (bare soil on new canal bank), in association with other xenophytes like *Sporobolus vaginiflorus* (A. Gray) Alph. Wood. In addition, *D. violascens* was found on a gravelly riverbank of the Ticino-river, accompanied by numerous xenophytes of riverine communities: *Amaranthus bouchonii* Thell., *Ambrosia artemisiifolia* L., *Bidens frondosa* L., *Chamaesyce* cf. *maculata* (L.) Small, *Chenopodium ambrosioides* L., *Commelina communis* L., *Cyperus microiria* Steud., *Eleusine indica* (L.) Gaertn., *Eragrostis pectinacea* (Michx.) Nees, *Humulus japonicus* (Siebold) Zucc., *Lindernia dubia* (L.) Pennell, *Panicum dichotomiflorum* Michx., *Persicaria pensylvanica* (L.) M. Gómez, *Senecio inaequidens* DC., *Sicyos angulatus* L. and *Solanum lycopersicum* L.

Digitaria ischaemum is a rather exceptional species in the area where *D. violascens* recently became naturalized (south-eastern France, northwestern Italy). In the Italian province of Piacenza for instance, *D. ischaemum* has not been recorded for one hundred years (BANFI & al., 2005). In the surroundings of Milano, it is a casual alien (BANFI & GALASSO, 1998). In the valley of the Ticino River, *D. ischaemum* is still present (pers. obs. near Oleggio, 7.IX.2004) and thus confusion with *D. violascens* is likely.

Identification key to the species of *Digitaria* Haller in south-western Europe

1. Most spikelets ternate (in groups of three on the rachis). Upper lemma dark brown or black at maturity 2

1a. Most spikelets binate (in groups of two on the rachis). Upper lemma yellowish, tan or greyish-brown at maturity 3

2 Spikelets usually at least 2 mm long, rarely shorter ((1.6-)2-2.5 mm). Spikelets usually densely hairy (at least when young) with curled hairs, some hairs usually with clavate apices. Inflorescence usually subdigitate with a distinct common axis, racemes usually 2-3(-4), rarely more, spreading horizontally at anthesis (at least the lowermost). Upper glumes 3-5-nerved, lower lemmas with nerves not equidistantly spaced ..... ***D. ischaemum***

2a. Spikelets usually slightly shorter than 2 mm, rarely longer ((1,2-)1,8-2(-2,1) mm). Spikelets usually less hairy (even when young) with straight hairs (hairs with clavate apices absent). Inflorescence usually digitate without or with an indistinct common axis, racemes usually (2-)3-7, often long remaining erect during anthesis. Upper glumes 3-nerved, lower lemmas with nerves equidistantly spaced ..... **3. *D. violascens***

3 Upper glumes equaling or longer than the lower lemma. Inflorescence axes not winged or with a very narrow wing, the wing at most 0.5 mm wide 4

3a. Upper glumes at most 2/3 as long as lower lemma. Inflorescence axes broadly winged, the wing commonly ca. 1 mm wide 5

4 Upper glumes equaling the lower lemma, acute-acuminate, not long-tapering at apex ..... ***D. aequiglumis***

4a. Upper glumes longer than lower lemma, gradually long-tapering at apex ..... **1. *D. debilis***

5 Marginal nerves of lower lemma with minute prickles throughout ..... ***D. sanguinalis***

5a. Marginal nerves of lower lemma smooth or with few prickles on the upper third 6

6 Spikelets narrow, 0.6-0.7 mm wide. Upper glumes less than ½ the length of the spikelet. Slender annuals with 2 or 3(-4) inflorescence branches. Inflorescence axes with few prickels to almost smooth ..... **2. *D. radicosa***

6a. Spikelets broader, 0.7-1.1 mm wide. Upper glumes usually more than ½ the length of the spikelet. Often more robust annuals, usually with more inflorescence branches (3-10). Inflorescence axes scabrous throughout ..... ***D. ciliaris***

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Christophe Girod (Brignais, France), James Molina (Montpellier, France) and Jean-Marc Tison (L'Isle d'Abeau, France) kindly provided additional records and/or herbarium specimens of *D. violascens* from France. Jacques Lambinon (University of Liège, Belgium) offered on loan relevant herbarium collections of *Digitaria* from LG. Finally, Sven Bellanger (National Botanic Garden, Belgium) prepared the original line drawings.

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