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Studies in the genus *Paspalum* (*Paniceae, Poaceae*) in Europe – 2. The *Quadrifaria* group

Abstract


The South American *Paspalum quadrifarium* has been reported as a naturalized xenophyte in Tuscany and Liguria, Italy, since at least the 1960s. In the present contribution the discovery of the closely related *P. exaltatum*, also of South American origin, in Liguria, Italy, is reported. These are the only known occurrences in Europe of both species, which are very similar to each other and likely to be confused. In the present paper their diagnostic features are discussed and original line drawings and SEM photographs for both taxa are presented. Their current distribution in Italy is shown and some ecological remarks are added.

Key words: *Paspalum quadrifarium*, *Paspalum exaltatum*, xenophyte, Italy, taxonomy, distribution.

Introduction

A concise botanical inventory by the first author of the surroundings of Cogoleto (Liguria, province of Genoa, Italy), well known for its remarkable diversity of alien plants (Peccenini & al. 1991), in June 2005 yielded several records of a tall, densely caespitose species of *Paspalum*. Initially, these were taken for *P. quadrifarium* Lam., known as a locally naturalized xenophyte in the surroundings of Pisa, Tuscany (Garbari 1966, 1972, Viegi & Cela Renzoni 1981), and Arenzano, Liguria (Barberis & Mariotti 1982), and likely to occur elsewhere in the northwestern coastal areas of Italy.

Voucher specimens from Liguria and Tuscany were carefully studied and compared with numerous native collections of taxa of the *Quadrifaria* group. It soon became evident that the Italian plants belong to two closely related but distinct taxa, *Paspalum exaltatum* J. Presl and *P. quadrifarium*. The former seems to have never been recorded before in Italy (Gentile 1992, Conti & al. 2005) nor elsewhere in Europe.

In the present paper the main diagnostic characters of both taxa are discussed and original line drawings and SEM photographs for both are presented. Some further chorological and ecological comments are also provided.
Taxonomy

The informal Quadrifaria group of Paspalum comprises a few South American species characterized by their tall (usually more than 100 cm), densely caespitose habit, long, rigid leaves, terminal pyramidal panicles with numerous racemously arranged branches and paired ochreous to purplish spikelets (Fig. 1A-B). Barreto (1966) distinguished ten taxa and subsequently a few additional taxa were described (P. dasytrichium Swallen 1967), P. zuloagae Davide & Filg. (Filgueiras & Davidse 1995) and P. quarinii Morrone & Zuloaga (2000). A further taxon, P. chapadense Swallen (1967), is today considered conspecific with P. coryphaeum Trin. The species are remarkably confined to rather moist habitats (Barreto 1966).

The group is represented in Europe by two species, which can be keyed out as follows:

1. Spikelets 3-3.5 mm long, (sub)acute, the lower lemma and upper glume slightly longer than the upper floret; upper glume less pubescent to subglabrous without bulbous-based hairs . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
Fig. 1. Comparison of *Paspalum quadrifarium* and *P. exaltatum* – A-B: habit (A), inflorescence (B) in both species; C-G: *P. quadrifarium* – upper floret in dorsal view showing lemma (C); upper floret in ventral view showing palea and margins of lemma (D); spikelet in lateral view (E); spikelet in dorsal view showing upper glume (F); spikelet in ventral view showing sterile lemma (G); after F. Verloove 6004. – H-L: *P. exaltatum* – upper floret in dorsal (H) and ventral (I) view; spikelet in lateral (J); dorsal (K) and ventral (L) view; after F. Garbari, 23.9.1966. – Scale bars: A = 20 cm, B = 5 cm, C-L = 1 mm. – Drawn by Marc Reynders.

*Densely caespitose perennial,* usually glaucous; *culm* 120-250 cm tall, erect, glabrous. *Leaf sheaths* glabrous; *leaf blades* 30-70 cm long and 4-10(-15) mm wide, plane or involute, rigid, glabrous; ligule membranous, 2-4 mm long. *Inflorescence* terminal, at first linear, becoming pyramidal, 17-30 × 2-10 cm, with (10-)20-30(-35) racemosely arranged branches; branches ascending to divergent, 2-7(-10) cm long, the lowermost longer than the uppermost; branch axes 5-10 mm wide, plane. *Spikelets* (2.8-)3-3.5(-4) × 1.2-1.6 mm, paired, broadly elliptic and subacute, plane-convex, usually pubescent or subglabrous; lower glume wanting or vestigial, upper glume and lower lemma subequal, 0.4-0.8 mm longer than the upper floret, upper floret 2.8 mm long, elliptic, stramineous.

*Origin.* – South America (Argentina, Brazil, Paraguay, Uruguay). Reported as a xenophyte in Australia (Tothill & Hacker 1983, Webster 1987).

*Ic.* – Fig. 1, 2; Barreto (1966: fig. 2), Burkart (1969: fig. 169), Smith & al. (1982: fig. 199).

*Flowering.* – June to September (inflorescences probably present all year round).

*Distribution in Europe.* – So far only known from Italy, recorded for the first time in 2005 in the surroundings of Cogoleto, prov. Genoa, Liguria, see Fig. 3.


*Densely caespitose perennial; culm* (50-)100-150(-180) cm tall, erect, glabrous (or sometimes pubescent on the nodes). *Leaf sheaths* glabrous; *leaf blades* 15-50(-65) cm long and 3-8 mm wide, plane or involute, rigid, usually glabrous; ligule membranous, 2-6 mm long. *Inflorescence* terminal, pyramidal, 12-30 × 2-4 cm, with (10-)15-40 racemosely arranged branches; branches ascending to divergent, 2-7(-10) cm long, the lowermost longer than the uppermost; branch axes 5-6 mm wide, plane. *Spikelets* (1.6-)2-2.5 × 0.8-1.3 mm, paired, elliptic and subobtuse, plane-convex, densely pubescent with bulbous-based hairs, bulbs dark-coloured; lower glume wanting or vestigial, upper glume and lower lemma subequal, as long as the upper floret, upper floret 2.2-2.5 mm long, elliptic, white.

*Origin.* – South America (Argentina, Brazil, Paraguay, Uruguay). Reported as a naturalized alien and a declared noxious weed in Australia (New South Wales and Queensland, see Webster 1987, Jacobs & Wall 1993; more recently also in Victoria, see Walsh & Entwisle 1994) and as an occasional garden escape in Florida (North America, see Allen & Hall 2003). *Paspalum quadrifarium* was not yet mentioned by Chase (1929) or Hitchcock (1951) and appears to be a fairly recent introduction in the USA.

*Ic.* – Fig. 1, 2; Barreto (1966: fig. 1B), Smith & al. (1982: fig. 200), Allen & Hall (2003: fig. p. 589).

*Flowering.* – June to September (inflorescences probably present all year round).

*Distribution in Europe.* – So far only known from Italy, recorded for the first time in 1966 around San Giuliano Terme between Pisa and Lucca, prov. Pisa, Tuscany. Subsequently recorded elsewhere in the surroundings and more recently extending northwards up to Arenzano in prov.
Genoa, Liguria (Barberis & Mariotti 1982). For detailed localities see Garbari (1966, 1972), Fig. 3 and the specimens seen.


Fig. 2. Scanning electron micrographs. – A, C, E: *Paspalum quadrifarium* – spikelet tip (A); detail of hairs on upper glume (C); detail of bulbous-based hair (E); from F. Verloove 6004. – B, D, F: *P. exaltatum* – spikelet tip (B); detail of hairs on upper glume (D); detail of silica bodies on the upper floret (F); from F. Garbari 23.9.1966.
Ecological notes

In its area of origin *Paspalum exaltatum* inhabits irrigated fields, river banks, lake shores and other moist habitats. It generally appears to be non-weedy. In Australia *P. exaltatum* is a rare and very local xenophyte of uncertain status; it is confined to coastal lowlands (Tothill & Hacker 1983).

Near Cogoletto *Paspalum exaltatum* usually grows along dry as well as moderately humid, undisturbed or only slightly disturbed roadsides. It is usually accompanied by native species such as *Dactylis glomerata*, *Dittrichia viscosa*, *Eupatorium cannabinum*, *Festuca arundinacea*/*pratensis* and *Holcus lanatus*. More rarely the species locally starts to penetrate adjacent pastures and orchards or even more or less ruderalized macchie.

*Paspalum exaltatum* seems to be a relatively recent introduction around Cogoletto, since its current distribution is concentrated primarily along one road over a distance of not more than five kilometres. At present the species is most abundant around Schiva, where monospecific stands are frequent and where it also grows along some small roads branched off. It doubtlessly is its initial area of introduction.

The mode of introduction of *Paspalum exaltatum* in Italy remains uncertain. As its area of naturalization is one with rather few anthropogenous influences and no industrial activities, the
species most likely escaped from a garden. Surprisingly, it is not or unfrequently grown in Europe (see for instance Walters & al. 1984, Grounds 1989, Oakes 1990). In Argentina, *P. exaltatum* and *P. quadrifarium* are increasingly promoted for deliberate introduction. They are (among others) used for the restoration of natural prairies, dune fixation, control of erosion (Rúgolo de Agrasar & Puglia 2004).

In South America *Paspalum quadrifarium* prefers the same moist habitats as *P. exaltatum* (river banks, lake shores, moist fields). In addition it also grows in savannas on clay or sand. Outside its original range *P. quadrifarium* mostly grows in disturbed, unknown areas (Allen & Hall 2003, Jacobs & Wall 1993). Remarkably, its Italian ecological niche corresponds well with the native one since it is chiefly found along river banks (see Garbari 1972).

With its graceful stature *Paspalum quadrifarium* has some horticultural value and it is sometimes cultivated as an ornamental grass (“crown grass”, “golden-top grass”, “tussock paspalum” or “evergreen paspalum”), especially in the Americas. It is not treated as such for Europe by Walters & al. (1984). The origin of the Italian populations remains unclear so far; Garbari (1972) suggested several possibilities ranging from an unintentionally introduced grain alien to a garden escape.

In its native range *Paspalum quadrifarium* is only known as a weed in Uruguay (Holm & al. 1979). *P. quadrifarium* is – primarily outside its original distribution range – known for its reputed invasiveness, especially in Australia. In Sydney, for instance, it is a declared noxious weed that, once established, forms extremely dense infestations that outcompete native vegetation (Sydney Weeds Committees 2005). In Queensland *P. quadrifarium* inhabits humid coastal and subcoastal ranges, highlands and closed forests (Tothill & Hacker 1983).

In view of the invasive behaviour of *Paspalum quadrifarium* and the potential invasiveness of *P. exaltatum*, monitoring of the future spread of both taxa in Italy appears appropriate.

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