

## Short communication

# First Italian record of *Paspalum notatum* Flügge (Poaceae) and its typification

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**Abstract:** In the present work the presence of *Paspalum notatum* Flügge (Poaceae) in Italy was reported for the first time. It is a neophyte native to America, known for applications in phytoremediation. Its typification, ecology and invasiveness status are also presented.

**Keywords:** alien species, invasiveness, phytoremediation, vascular flora

## Introduction

The genus *Paspalum* L. (Poaceae) comprises about 330 species (Zuloaga and Morrone 2005) and is chiefly distributed in tropical and temperate regions of America (Zuloaga et al. 2003). It includes small to robust perennial, rarely annual, herbs that are usually cespitose, but may creep via rhizomes or stolons, and have filiform to lanceolate leaf blades, which may be flat, plicate, or involute. The inflorescence is racemose, unilateral, with solitary or paired spikelets. The lower glume is commonly absent, the upper one and the lower lemma are herbaceous to membranous, and the upper antherium is indurate to membranous.

In the European vascular flora 10 species have been recorded (Valdés et al. 2009–2014), among which 6 are present in Italy, all aliens (Celesti-Grapow et al. 2009a, b, Soldano and Verloove 2015): *P. dilatatum* Poir., *P. distichum* L., *P. exaltatum* J. Presl & C. Presl, *P. paucispicatum* Vasey, *P. quadrifarium* Lam. and *P. vaginatum* Sw. From recently, another two alien species are in course of reporting in Italy: *P. dasyleurum* Kunze ex Desv. and *P. thunbergii* Kunth ex Steud. (Banfi and Galasso 2015)

In this paper the neotropical neophyte *P. notatum* Flügge (Bahigrass) is recorded for the first time in Italy. Its typification, ecology and invasiveness status are also presented.

## Materials and methods

Field research in Southern Italy was undertaken from 2013 to 2015. Species was identified according to Zuloaga et al. (2004), Zuloaga and Morrone (2005), and Allen and Hall (2002). The Flügge's (1810) protologue was also examined. Collected specimens are kept in Herbarium Porti-

cense (PORUN, acronym according to Thiers 2011) and Museo di Storia Naturale di Milano (MSNM). Geocoding of the Italian locality of the plant was performed with the use of a portable GPS device (GPS map 60CSx, Garmin, USA), calibrated beforehand (geographic system UTM WGS84).

Italian literature was examined to detect previous indications of the species in Italy (e.g. Fiori 1923, Zangheri 1976, Pignatti 1982, Conti et al. 2005, 2007, Celesti-Grapow et al. 2009a, b, 2010). The degree of naturalization (status) was defined according to Richardson et al. (2000) and Pyšek et al. (2004) through the monitoring of the Italian population. In detail was observed the presence of the species and its ability to spread in the field in three consecutive years (2013–2015).

## Results and discussion

*Paspalum notatum* Flügge (sub *Paspalus notatus*), Gram. Monogr., Paspalum: 106(–108, 207–208). 1810 [5.V.1810].

Typus, *hic designatus*: United States Virgin Islands, St. Thomas, *E. P. Ventenat s.n.*, 1802; lectotypus in BM-ex Herb. Nolte (picture in SI!), isolectotypus in US-2855762! (fragm. ex BM). We were not able to find the duplicates kept in B, KIEL, MO, P-LA, presumably being destroyed during the Second World War. The present typification is a consequence of the fact that Koning and Sosef (1985: 313) indicated isolectotypi on a set of several herbaria, while Zuloaga and Morrone (2005: 180) did not establish a valid typification as they didn't use the phrase "designated here" (*hic designatus*) or an equivalent (Art. 7.10 of ICN, McNeill et al. 2012).

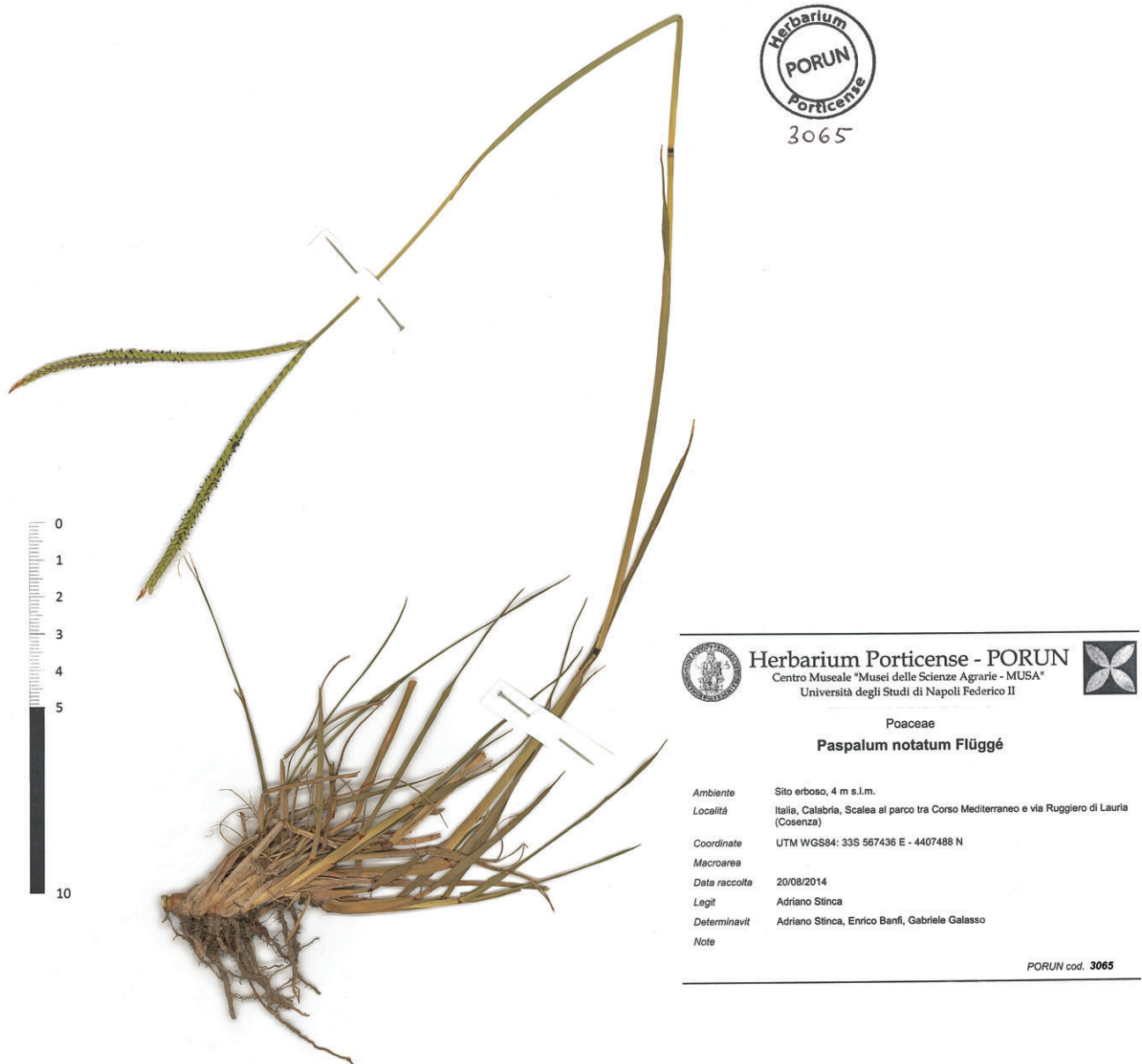
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= *Paspalum notatum* var. *saurae* Parodi, Revista Argent. Agron. 15(1): 55 (fig. 1b). 1948.  
 ≡ *Paspalum saurae* (Parodi) Parodi, Darwiniana 15(1-2): 106. 1969 [30.I.1969].

Typus: Argentina, Entre Ríos: Concepción del Uruguay, L. R. Parodi 12670, January 1937; holotypus in BAA, isotypus in US-1721333!



**Fig. 1.** Distribution of *Paspalum notatum* in Europe (including Azores and Canary Islands) with the first Italian record (star) and previous reports (circles: 1 – Scholz 2002; 2 – Pyke 2003; 3 – Verloove 2003; 4 – Verloove 2005; 5 – Böhring and Scholz 2004; 6 – Silva et al. 2005; 7 – Sánchez Gullón et al. 2006; 8 – Valdés et al. 2007; 9 – Verloove and Reyes-Betancort 2011; 10 – Siverio Núñez et al. 2013).



**Fig. 2.** Italian specimen of *Paspalum notatum* preserved at PORUN.

*P. notatum* is common in pastures along the belt warm and temperate American regions, from central Mexico to Uruguay (e.g. Quarín et al. 1984). It was introduced in tropical and subtropical areas of the world for purposes of turf establishment, forage crop growth, erosion control and slope stabilization (e.g. Busey 1992, Ogura et al. 2005). In recent years, this grass has been found effective in renaturation of vegetation of mined lands, uptake of heavy metals and even removal of radioactive elements (phytoremediation) (e.g. Xia 2004, Huang et al. 2009). In addition, laboratory experiments have shown that pollen of this plant cause allergic respiratory diseases (Davies et al. 2012).

*P. notatum* was collected at Scalea (province of Cosenza) in Southern Italy. The site is located on the Tyrrhenian coast of the Calabria region in the northern sector of the Lao river plain, at 4–5 m a.s.l. (UTM WGS84: 33S 567494 E – 4407547 N, 33S 567436 E – 4407488 N, and 33S 567427 E – 4407484 N).

Climate (thermopluviometric data from Fiumefreddo meteorological station, 220 m a.s.l., about 65 km from the studied site) belongs to the Mediterranean type characterized by average annual temperature of 16.7 °C, average annual rainfall of 1,141 mm, and drought summer period ranging from May to August (Brandmayr et al. 1991).

*P. notatum* was found in very disturbed grassland sites. This alien species was probably introduced via seeds to create lawns and therefore subsequently spread. The discovered population covers an area of approximately 300 m<sup>2</sup>. It shares the place with *Avena barbata* Pott ex Link, *Cynodon dactylon* (L.) Pers., *Dactylis glomerata* L. subsp. *glomerata*, *Oxalis corniculata* L., *Parietaria judaica* L., *Reichardia picroides* (L.) Roth, *Solanum nigrum* L., *S. villosum* Mill., *Sonchus oleraceus* L., and with other aliens, i.e. *Chamaesyce maculata* (L.) Small, *Erigeron sumatrensis* Retz., *Paspalum dilatatum* Poir., *P. distichum* L., that emphasize the human impact.

## References

- Allen, C. M., Hall, D. W., 2002: 25.26 *Paspalum* L. In: Flora of North America Editorial Committee (eds.), Flora of North America North of Mexico, 25 (*Magnoliophyta: Commelinidae* (in part): Poaceae, part 2), 566–599. Oxford University Press, New York, Oxford.
- Banfi, E., Galasso, G., 2015: *Paspalum* (Poaceae), aggiornamento per la flora italiana. In: Peruzzi, L., Domina, G. (eds.), *Approfondimenti floristici e sistematici sulla flora d'Italia. Dedicato a Edda Lattanzi in occasione dei suoi 85 anni. Comunicazioni*, 41–42. Orto botanico di Roma, La Sapienza Università di Roma, 20–21 novembre 2015. Società Botanica Italiana. Gruppo per la Floristica, Sistematica ed Evoluzione, Firenze.
- Böhling, N., Scholz, H., 2004: *Paspalum notatum* Flügge. In: Greuter, W., Raus, T. (eds.), *Med-Checklist Notulae* 22. *Willdenowia* 34, 79.
- Brandmayr, P., Codogno, M., Pizzolotto, R., 1991: Basi ecologiche per la mappatura delle risorse naturali in Calabria: biomi ed unità ambientali minori lungo la sezione Catena Costiera – Sila Grande – Sila Greca. *Atti IV Congresso della Società Italiana di Ecologia*, 389–393.
- Busey, P., 1992: Seedling growth, fertilization timing, and establishment of bahiagrass. *Crop Science* 32, 1099–1103.
- Celesti-Grapow, L., Alessandrini, A., Arrigoni, P. V., Banfi, E., Bernardo, L., Bovio, M., Brundu, G., Cagiotti, M. R., Camarda, L., Carli, E., Conti, F., Fascetti, S., Galasso, G., Gubellini, L., La Valva, V., Lucchese, F., Marchiori, S., Mazzola, P., Peccenini, S., Poldini, L., Pretto, F., Prosser, F., Siniscalco, C., Villani, M. C., Viegli, L., Wilhelm, T., Blasi, C., 2009a: Inventory of the non-native flora of Italy. *Plant Biosystems* 143, 386–430.
- Celesti-Grapow, L., Pretto, F., Brundu, G., Carli, E., Blasi, C. (eds.), 2009b: A thematic contribution to the National Biodiversity Strategy. *Plant invasion in Italy, an overview*. Ministry for the Environment Land and Sea Protection, Nature Protection Directorate, Roma, 1–32 + CD-ROM.
- Celesti-Grapow, L., Pretto, F., Carli, E., Blasi, C. (eds.), 2010: *Flora alloctona e invasiva delle regioni d'Italia*. Casa Editrice Università La Sapienza, Roma.
- Conti, F., Abbate, G., Alessandrini, A., Blasi, C. (eds.), 2005: *An annotated checklist of the Italian vascular flora*. Palombi Editori, Roma.
- Conti, F., Alessandrini, A., Bacchetta, G., Banfi, E., Barberis, G., Bartolucci, F., Bernardo, L., Bonacquisti, S., Bouvet, D.,

Today in Europe (Fig. 1) *P. notatum* has been reported in Greece (Scholz 2002), Spain (Böhling and Scholz 2004, Sánchez Gullón et al. 2006, Valdés et al. 2007), and Azores Islands in Portugal (Silva et al. 2005). In Spain (Pyke 2003, Verloove 2003, 2005, Verloove and Reyes-Betancort 2011) and Canary Islands (Siverio Núñez et al. 2013, finding confirmed by Verloove and Reyes-Betancort 2011) the var. *saurae* (synonym by *P. notatum* according to Allen and Hall 2002) was also recorded, and it presents the same morphological features of the new Italian population.

In Italy *P. notatum* was detected for three consecutive years (2013–2015), showing a noticeable vegetative propagation. According to Richardson et al. (2000) and Pyšek et al. (2004), the observation period is too short to understand the real success of vegetative propagation and declare a state of naturalized species. Therefore it must be considered an alien casual, waiting for further field investigations to achieve the proper status attribution.

## Specimina visa

ITALY: Calabria, Scalea (Cosenza), park between Corso Mediterraneo and via Michele Bianchi (UTM WGS84: 33S 567494 E – 4407547 N), mowed lawn, 5 m a.s.l., no exp., 14 Aug 2013, leg. A. Stinca, det. E. Banfi & G. Galasso (PORUN-3063, MSNM-44681); Calabria, Scalea (Cosenza), park between Corso Mediterraneo and via Ruggero di Lauria (UTM WGS84: 33S 567436 E – 4407488 N), grassy site, 4 m a.s.l., no exp., 20 Aug 2014, leg. A. Stinca, det. A. Stinca, E. Banfi & G. Galasso (PORUN-3064-3065, MSNM-45057) (Fig. 2); Calabria, Scalea (Cosenza), park between Corso Mediterraneo and via Ruggero di Lauria (UTM WGS84: 33S 567427 E – 4407484 N), grassy site, 4 m a.s.l., no exp., 16 Aug 2015, leg. A. Stinca & M. Ravo, det. A. Stinca (PORUN-3577).

USA: United States Virgin Islands, St. Thomas, *E. P. Ventenat s.n.*, 1802 [BM (picture in SI, US-2855762 (fragm. ex BM))].

- Bovio, M., Brusa, G., Del Guacchio, E., Foggi, B., Frattini, S., Galasso, G., Gallo, L., Gangale, C., Gottschlich, G., Grünanger, P., Gubellini, L., Iiriti, G., Lucarini, D., Marchetti, D., Moraldo, B., Peruzzi, L., Poldini, L., Prosser, F., Raffaelli, M., Santangelo, A., Scassellati, E., Scortegagna, S., Selvi, F., Soldano, A., Tinti, D., Ubaldi, D., Uzunov, D., Vidali, M., 2007: Integrazioni alla checklist della flora vascolare italiana. *Natura Vicentina* 10, 5–74.
- Davies, J. M., Li, H., Green, M., Towers, M., Upham, J. W., 2012: Subtropical grass pollen allergens are important for allergic respiratory diseases in subtropical regions. *Clinical and Translational Allergy* 2, 4. doi:10.1186/2045-7022-2-4
- Fiori, A., 1923: Nuova flora analitica d'Italia contenente la descrizione delle piante vascolari indigene, inselvatichite e largamente coltivate in Italia 1, 80–81. Tipografia di M. Ricci, Firenze.
- Flüggé, J., 1810: Graminum monographiae. Pars I. *Paspalus*. Reimaria, 106–108, 207–208. Impensis F. Pertheset J. H. Besser, Hanburgi.
- Huang, J., Xia, H., Li, Z., Xiong, Y., Kong, G., 2009: Soil aluminum uptake and accumulation by *Paspalum notatum*. *Waste Management and Research* 27, 668–675.
- Koning, R. De, Sosef, M. S. M., 1985: The Malesian species of *Paspalum* L. (Gramineae). *Blumea* 30, 279–318.
- McNeill, J., Barrie, F. R., Buck, W. R., Demoulin, V., Greuter, W., Hawksworth, D. L., Herendeen, P. S., Knapp, S., Marhold, K., Prado, J., Prud'homme, Van Reine, W. F., Smith, G. F., Wiersema, J. H., Turland, N. J. (eds.), 2012: International code of nomenclature for algae, fungi, and plants (Melbourne Code) adopted by the Eighteenth International Botanical Congress Melbourne, Australia, July 2011. *Regnum Veg.*, Königstein, 154, 1–208.
- Ogura, S., Nagatomo, Y., Hirata, M., 2005: Estimation of herbage mass in a bahia grass (*Paspalum notatum*) and a centipede grass (*Eremochloa ophiuroides*) pasture using a capacitance probe, a sward stick and a rising plate. *Tropical Grasslands* 39, 22–30.
- Pignatti, S. 1982; *Flora d'Italia* 3, 611. Edagricole, Bologna.
- Pyke, S., 2003: Catálogo florístico de las plantas vasculares de Zaragoza. Publicaciones del Consejo de Protección de la Naturaleza de Aragón, Zaragoza.
- Pyšek, P., Richardson, D. M., Rejmánek, M., Webster, G. L., Williamson, M., Kirschner, J., 2004: Alien plants in checklist and floras: towards better communication between taxonomists and ecologists. *Taxon* 53, 131–143.
- Quarín, C. L., Burson, B. L., Burton, G. W., 1984: Cytology of intra- and interspecific hybrids between two cytotypes of *Paspalum notatum* and *P. cromyorrhizon*. *Botanical Gazette* 145, 420–426.
- Richardson, D. M., Pyšek, P., Rejmánek, M., Barbour, M. G., Panetta, F. D., West, C. J., 2000: Naturalization and invasion of alien plants: concept and definitions. *Diversity and Distributions* 6, 93–107.
- Sánchez Gullón, E., Valdés, B., Macías-Fuentes, F. J., Weickert P., 2006: Notas para la flora de la provincia de Huelva (SO de España). *Lagasalia* 26, 187–196.
- Scholz, H., 2002: *Paspalum notatum* Flüggé. In: Greuter, W., Raus, T. (eds.), *Med-Checklist Notulae* 21. *Willdenowia* 32, 206.
- Silva, L., Pinto, N., Press, B., Rumsay, F., Carine, M., Henderson, S., Sjögren, E., 2005: Lista das plantas vasculares (*Pteridophyta* e *Spermatophyta*). In: Borges, P. A. V., Cunha, R., Gabriel, R., Martins, A. F., Silva, L., Vieira V. (eds.), *A list of the terrestrial fauna (Mollusca and Arthropoda) and flora (Bryophyta, Pteridophyta and Spermatophyta) from the Azores*, 131–156. Direcção Regional do Ambiente and Universidade dos Açores, Horta, Angra do Heroísmo and Ponta Delgada.
- Siverio Núñez, A., Sobrino Vesperinas, E., Rodríguez De La Torre, H. A., Reyes-Betancort, J. A., Santos Guerra, A. 2013: Nuevos xenófitos de elevada capacidad invasora para la Flora Canaria. *Botánica Macaronésica* 28, 165–173.
- Soldano, A., Verloove, F., 2015: Nota N. 676. *Paspalum Paucispicatum* Vasey. In: Selvaggi, A., Soldano, A., Pascale, M., Dellavedova, R. (eds.), *Note floristiche piemontesi n. 604–705*. Rivista piemontese di Storia naturale 36, 315–316.
- Thiers, B., 2011: Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. Retrieved September 29, 2014 from <http://sweetgum.nybg.org/ih/>
- Valdés, B., Girón, V., Sánchez Gullón, E., Carmona, I., 2007: Catálogo florístico del espacio natural de Doñana (SO de España). *Plantas vasculares*. *Lagasalia* 27, 73–362.
- Valdés, B., Scholz, H., Raab-Straube, E. Von, Parolly, G., 2009–2014: *Paspalum* L. Euro+Med Plantbase. Retrieved October 1, 2014 from <http://ww2.bgbm.org/EuroPlusMed/PTaxonDetail.asp?NameCache=Paspalum&PTrEffk=7100000>
- Verloove, F., 2003: *Physalis ixocarpa* Brot. ex Hornem. and *Verbena litoralis* Kunth, new Spanish xenophytes and records of other interesting alien vascular plants in Catalonia (Spain). *Lazaroa* 24, 7–11.
- Verloove, F., 2005: New records of interesting xenophytes in Spain. *Lazaroa* 26, 141–148.
- Verloove, F., Reyes-Betancort, J. A., 2011: Additions to the flora of Tenerife (Canary Islands, Spain). *Collectanea Botanica* 30, 63–78.
- Xia, H. P., 2004: Ecological rehabilitation and phytoremediation with four grasses in oil shale mined land. *Chemosphere* 54, 345–353.
- Zangheri, P., 1976: *Flora Italica* 1, 909–910. CEDAM, Padova.
- Zuloaga, F. O., Morrone, O., 2005: Revisión de las especies de *Paspalum* para América del Sur Austral (Argentina, Bolivia, Sur de Brasil, Chile, Paraguay y Uruguay). *Monographs in systematic botany from the Missouri Botanical Garden* 102, 1–297.
- Zuloaga, F. O., Morrone, O., Davidse, G., Filgueiras, T. S., Peterson, P. M., Soreng, R. J., Judziewicz, E., 2003: Catalogue of New World grasses (Poaceae): III. Subfamilies *Panicoideae*, *Aristidoideae*, *Arundinoideae*, and *Danthonioideae*. *Contributions from the United States National Herbarium* 46, 1–662.
- Zuloaga, F. O., Pensiero, J., Morrone, O. 2004: Systematics of *Paspalum* group notata (Poaceae-Panicoideae-Paniceae). *Systematic Botany Monographs* 71, 1–75.