Nomenclature and taxonomy of Ornithogalum divergens Boreau (Hyacinthaceae) and related taxa of the polyploid complex of Ornithogalum umbellatum L.

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Nomenclature and taxonomy of Ornithogalum divergens Boreau (Hyacinthaceae) and related taxa of the polyploid complex of Ornithogalum umbellatum L.

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Abstract

MARTÍNEZ-AZORÍN, M., M. B. CRESPO & A. JUAN (2009). Nomenclature and taxonomy of Ornithogalum divergens Boreau (Hyacinthaceae) and related taxa of the polyploid complex of Ornithogalum umbellatum L. *Candollea* 64: 163-169. In English, English and French abstracts.

The nomenclature and the taxonomy of *Ornithogalum divergens* Boreau *(Hyacinthaceae)* are reported. Synonymy includes closely related species, such as *Ornithogalum paterfamilias* Godron, *Ornithogalum hortense* Jord. & Fourr., *Ornithogalum declinatum* Jord. & Fourr. and *Ornithogalum proliferum* Jord. & Fourr. and different subspecies of *Ornithogalum umbellatum* L. For *Ornithogalum divergens*, one lectotype is designated, one lectotype is also designated for *Ornithogalum paterfamilias* as well as three neotypes for *Ornithogalum hortense, Ornithogalum declinatum* and *Ornithogalum proliferum*. Correct publication citations of the cited taxon descriptions are included and the ecology and distribution of *Ornithogalum divergens* is also presented.

Résumé

MARTÍNEZ-AZORÍN, M., M. B. CRESPO & A. JUAN (2009). Nomenclature et taxonomie d'Ornithogalum divergens Boreau (Hyacinthaceae) et des taxons en relation avec le complexe polyploide d'Ornithogalum umbellatum L. *Candollea* 64: 163-169. En anglais, résumés anglais et français.

La nomenclature et la taxonomie d'*Ornithogalum divergens* Boreau *(Hyacinthaceae)* sont présentées. La synonymie de cette espèce inclut des espèces proches, telles qu'*Ornithogalum paterfamilias* Godron, *Ornithogalum hortense* Jord. & Fourr., *Ornithogalum declinatum* Jord. & Fourr. et *Ornithogalum proliferum* Jord. & Fourr. ainsi que différentes sous-espèces d'*Ornithogalum umbellatum* L. Pour *Ornithogalum divergens*, un lectotype est désigné, un lectotype est aussi désigné pour *Ornithogalum paterfamilias* ainsi que trois néotypes pour *Ornithogalum hortense, Ornithogalum declinatum* et *Ornithogalum proliferum*. Les noms corrects des publications de toutes les descriptions des taxons cités ainsi que l'écologie et la distribution d'*Ornithogalum divergens* sont présentés.

Key-words

HYACINTHACEAE – Ornithogalum – Nomenclature – Typification – Taxonomy

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Introduction

Ornithogalum divergens Boreau *(Hyacinthaceae)* was described by Boreau (1847) from different sites in the Loire Valley (central-northern France), an area that is also the type locality of *O. umbellatum* L. (Stearn, 1983). *Ornithogalum divergens* is traditionally included in *Ornithogalum* L. subgen. *Ornithogalum* (= *Ornithogalum* subgen. *Heliocharmos* Baker) on the basis of the corymbose or pseudocorymbose inflorescence, white tepals with a longitudinal green stripe on the abaxial face, capsule 6-ribbed in section, and globose seeds with reticulate testa. Many species have been described in this group based on only small morphological differences, sometimes with little biological significance (Moret & Galland, 1992). This has frequently led not only to misidentifications but also to nomenclatural mistakes, generating an extremely confused taxonomy in this group (Peruzzi & al., 2007).

Most authors applied the name *O. divergens* to the hexaploid cytotype ($2n = 54$) of the polyploid complex of *O. umbellatum* L. s.l. (e.g. Gadella, 1972; Gadella & Raamsdonk, 1981; Speta, 2000; Garbari & al., 2008), though other interpretations are also available. That polyploid complex includes many cytotypes or ploidy levels which have been connected to two or three morphotypes (Gadella, 1972; Gadella & Raamsdonk, 1981; Moret, 1991; Moret & Favereau, 1991; Moret & Galland, 1991; Moret, 1992; Moret & Galland, 1992; Speta, 2000).

Regarding the taxonomic position of *O. divergens*, it was considered as a species (Boreau, 1847, 1849, 1857; Godron, 1854; Jordan & Fourrier, 1867; Coste, 1906; Coutinho, 1913, 1939; Pignatti, 1982; Feinbrun, 1986; Speta, 2000; Garbari & al., 2003, 2008; Conti & al., 2005), a subspecies (Ascherson & Graebner, 1905; Rouy, 1910; Maire, 1958; Meikle, 1985), a variety (Fiori, 1923), or as a mere hexaploid form of the polyploid complex of *O. umbellatum* (Tornadore & Garbari, 1979; Moret, 1991; Moret & Favereau, 1991; Moret & Galland, 1991, 1992).

However, according to Gadella (1972), Gadella & Raamsdonk (1981), Moret (1991, 1992), Moret & Galland (1992), Raamsdonk (1999), Speta (2000), Garbari & al. (2003, 2008), and Aquaro & Peruzzi (2006), it seems clear that *O. divergens* and *O. umbellatum* are two biological entities well-differentiated mainly by the inflorescence structure, the number, size and type of bulbils that can produce leaves or not (Fig. 1), as well as by their ploidy levels. Moreover, since both are reproductively isolated (Raamsdonk, 1985), evidence enough exists to maintain at least the triploid and hexaploid cytotypes as different species.

As a part of a taxonomic revision of *Ornithogalum*, nomenclatural aspects including typification of *O. divergens* and other closely related taxa (e.g. *O. paterfamilias* Godr., *O. hortense* Jord. & Fourr., *O. declinatum* Jord. & Fourr. or *O. proliferum* Jord. & Fourr.), are discussed here as the starting point for further taxonomic studies on the group. For typification purposes, original material of the cited taxa housed at ANG, LY, LYJB, NCY and SLL were studied, as well as dried and living plants from the type localities.

Taxonomy and typification of *Ornithogalum divergens*

Original description

Ornithogalum divergens was first published by Boreau (1847), clearly highlighting its diagnostic characters differing from the typical *O. umbellatum* and other close relatives. The publication place and date is still a matter of confusion. Boreau validated his new taxon as Note XXXVI, number 3, of the series "Notes sur quelques espèces de plantes françaises", which was dated in August 1847 and published in Volume 18 of the *Bulletin de la Société Industrielle d'Angers et du département de Maine et Loire* in 1847. The same publication was distributed that year as a reprint with independent pagination, which has been sometimes abbreviated as "Notes Pl. Franç. 3" (see *Index Kewensis*). Boreau (1849, 1857) included this species, adding each time new morphological observations or new localities. However, in the two later publications direct or indirect references to "*O. divergens*. Bor. Not. XXXVI. n° 3" were always made. Even in recent times, many authors erroneously cited the publication data of the species by referring to either 1849 or 1857 (Maire, 1958; Zahariadi, 1966, 1980; Meikle, 1985; Feinbrun, 1986). Only Speta (2000) adopted the correct publication and protologue. The same case applies to *O. angustifolium* Boreau, a name commonly synonymised with *O. umbellatum*.

Some other taxa described later from France, such as *O. paterfamilias* (Godron, 1854) or *O. hortense*, *O. declinatum* and *O. proliferum* (Jordan & Fourreau, 1866), were distinguished from *O. divergens* on the basis of small morphological features such as the size and shape of the inflorescences and flowers, the relative position of bulbils in relation to the outer tunics of the bulb, or the presence or absence of leaves in the bulbils. However, as they all share a similar inflorescence structure and bulbil characteristics, Coste (1906) and Rouy (1910) included or synonymized them with *O. divergens*.

Polyploidy

The name *O. divergens* is usually applied to hexaploid plants ($2n = 54$) with wide pseudocorymbose inflorescences, bearing very long and patent or slightly reflexed lower pedicels, with short bracts half as long as the subtending pedicel, and with bulbs producing many small (5-8 mm), spherical, long pedicellate bulbils (pedicel 2-8 mm long), usually

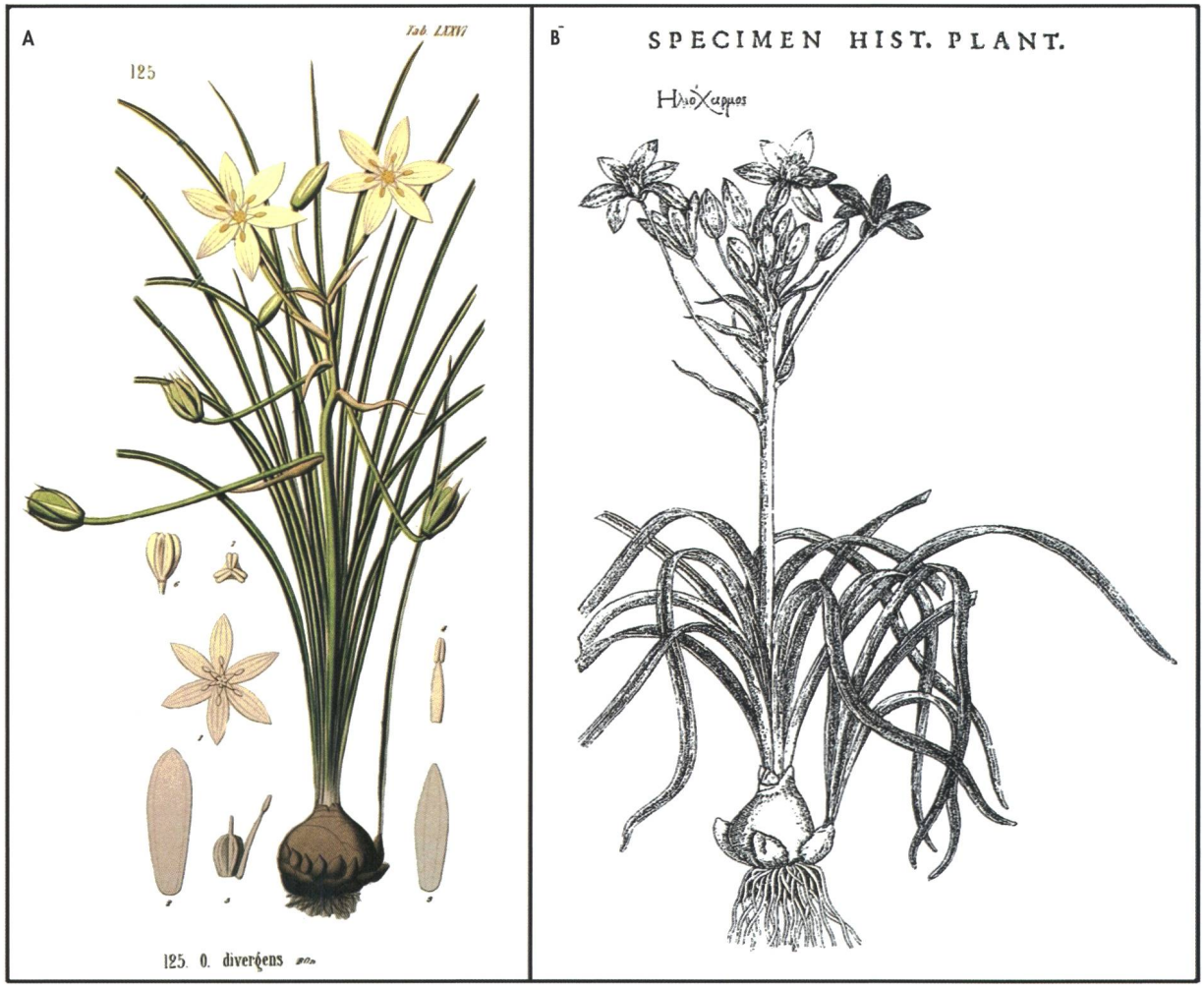

Fig. 1. – A. *Ornithogalum divergens* Boreau. Lowermost pedicels patent or reflexed, and bulb bearing many small, pedicellate bulbils (modified from JORDAN & FOURREAU, 1867); **B.** Lectotype of *O. umbellatum* L. showing erect-patent pedicels, and many leaved, bigger bulbils (from RENEAULME, 1611: tab. 87).

not leaved and attached to the basal plate (Fig. 1A). They can be easily differentiated from the triploid cytotype ($2n = 27$), to which the name *O. umbellatum* is commonly applied. Those plants produce corymbose inflorescence with the lowermost pedicels erect-patent, never reflexed, and bulbs bearing few sessile, medium size bulbils (up to 2 cm), most of them generating in their first year bunches of leaves surrounding the mother plant (Fig. 1B). In both cases, bulbils are always attached outwards from the inner tunics, and therefore they do not share the basal plate of the bulb, as occurs in the so-called "sister-bulbs" of the diploid taxa in the group (MORET & FAVEREAU, 1991).

Together with those triploid and hexaploid morphotypes, individuals with both tetraploid ($2n = 36$) and pentaploid cytotypes ($2n = 45$) occur in a single population (GADELLA & RAAMSDONK, 1981; MORET & GALLAND, 1991; MORET, 1992), though the former are very rare (only 8 populations out of 209 from central and western Europe were found by RAAMSDONK, 1986). Morphologically, pentaploids are almost identical to hexaploids (GADELLA & RAAMSDONK, 1981; RAAMSDONK, 1986; MORET, 1991; MORET & GALLAND, 1991, 1992), whilst tetraploids show similarities with either triploids or hexaploids almost in equal percentages (GADELLA & RAAMSDONK, 1981; RAAMSDONK, 1986). However, in a biosystematic study including mostly French populations of this aggregate, MORET & GALLAND (1992) found that all tetraploid individuals shared the same morphology as penta- and hexaploids, all three cytotypes fell together in a compact group that was well-differentiated from triploids. Similarly, SPETA (2000) connected triploids to *O. umbellatum* and hexaploids to *O. divergens*, and revived the name *O. vulgare* Sailer for tetra- and pentaploid plants from northern Austria.

However, GARBARI & al. (2003, 2008) reported a different scenario. On the one hand, they applied *O. divergens* exclusively to hexaploid plants that produced many, small and many-leaved bulbils. On the other, *O. umbellatum* (incl. *O. vulgare* and *O. angustifolium*) comprised triploid, tetraploid and pentaploid plants, which constituted a rather heterogeneous morphological aggregate. In their concept, triploids produce very few, relatively large and un-leaved bulbils, whilst tetraploids and pentaploids bear many, small and leaved bulbils, therefore being, to some extent, apparently close to hexaploids.

Typification

STEARN (1983) designated the Icône *87* published by RENEAULME (1611) as the lectotype of *O. umbellatum*, which depicts a single plant with three sessile and medium size bulbils, of which only one bears four long leaves (Fig. 1B). Previously, EL-GADI (1978) had lectotypified the Linnaean name based on the specimen *228.9* (LINN), whilst RAAMSDONK (1982) selected the sheet *428.13* (LINN). However, the former does not exist at LINN, and the latter was collected apparently by Hasselquist from the Middle East, and not from Germany or France as indicated in the protologue. All these reasons justify Stearn's proposal (JARVIS, 2007; see NATURAL HISTORY MUSEUM, 2009), which fits both the traditional and current use of the name. However, as GARBARI & al. (2008) pointed out, the different interpretations of the type of *O. umbellatum* led to nomenclatural treatments that opposed each other. GARBARI & al. (2008) remarked that the existence of leaves in one of the three bulbils of Stearn's lectotype would be in conflict with the phenotype of the triploid plants that they studied (with only dormant, leafless bulbils), and hence they suggested an eventual epitypification of *O. umbellatum* based a voucher matching their concept of that taxon. However, this should not be necessary since they amalgamated triploids, tetraploids and pentaploids under *O. umbellatum*, which included both *O. vulgare* ($2n = 36, 45$) and *O. angustifolium* ($2n = 27$) as synonyms. Moreover, morphotypes attributed to the different cytotypes by GARBARI & al. (2008) do not agree with data reported previously by many authors who associated the triploid cytotype with plants that had few, medium size and leaved bulbils (GADELLA, 1972; GADELLA & RAAMSDONK, 1981; RAAMSDONK, 1986; MORET, 1991; MORET & GALLAND, 1992). In this case, Stearn's lectotype of *O. umbellatum* fits perfectly with the current concept of the species, widely accepted by most authors.

The extreme cytotype variation found in the aggregate of *O. umbellatum*, in which many ploidy levels ($2n = 27, 36, 45, 54, 72, 90, 108$) occur together with diploids and aneuploids (NEVES, 1952; TORNADORE & GARBARI, 1979; GARBARI & al., 2003) is perhaps cause of the taxonomic and nomenclatural confusion. In our opinion, recognition of "microtaxa" based on cytotype differences and/or on very weak morphologic differences, though legitimate, is not desirable. Therefore, a synthetic arrangement is favoured here where only two morphotypes (taxa) are accepted, according to most previous studies in the group: *O. umbellatum* is applied to triploids, and *O. divergens* is applied to pentaploids and hexaploids. Tetraploids could be ascribed to either of the groups on the basis of their morphological traits, as shown by GADELLA & RAAMSDONK (1981), RAAMSDONK (1986), MORET & GALLAND (1992) and SPETA (2000). Related to that point, the cytological studies by MORET (1992) in the Loire Valley in the type locality of both *O. umbellatum* and *O. divergens*, were conclusive: "Thus, there is no longer any ambiguity. In the Loire Valley there really are two morphs: one ($2n = 3\times = 27$) corresponds to *O. umbellatum* (sensu Boreau) and the other ($2n = 5\times = 45$, $2n = 6\times = 54$) to *O. divergens* (sensu Boreau)". The situation seems to be not very different in central Europe.

Regarding *O. vulgare*, SAILER (1841) described this taxon from Oberösterreich (northern Austria) as possessing many bulbils, and referred it as the "false *umbellatum*". SPETA (2000) merged plants with two ploidy levels that corresponded to two morphotypes under that name: one that was closer to *O. divergens* (pentaploids) and the other perhaps closer to *O. umbellatum* (tetraploids). He also neotypified *O. vulgare* based on pentaploid material that matched the protologue. We were not able to study the neotype. Following the reasoning previously mentioned, Speta's broad concept of *O. vulgare* could be considered as an extreme of variation of either *O. divergens* or *O. umbellatum*. In the first case, the name *O. vulgare* would have priority over *O. divergens*. However, new evidence including from molecular data is needed before these two taxa are synonymized.

A fully satisfactory taxonomic solution to the whole aggregate has still not been achieved, and this is not the focus of the present contribution. Nonetheless, a general agreement seems to exist on the interpretation and use of the name *O. divergens*.

New typification

We have observed wild populations of *O. divergens* from Loire Valley, its type locality, and they are very homogeneous and match perfectly both the protologue and the current, widely accepted concept of the species. Nonetheless, some morphologic variation exists (e.g., flower size, inflorescence structure, and bulbil features) that include the phenotypic differences on which the four taxa cited above were based (GODRON, 1854; JORDAN & FOURREAU, 1866, 1867). These differences are not appropriate to segregate taxonomic entities, and we consider them to be synonyms of *O. divergens*.

Ornithogalum divergens Boreau in Bull. Soc. Industr. Angers 18: 419. 1847 [Notes Pl. Franç. 3: 15. 1847]

≡ *Ornithogalum umbellatum* subsp. *divergens* (Boreau) Asch. & Graebn., Syn. Mitteleur. Fl. 3: 246. 1905.

≡ *Ornithogalum umbellatum* var. *divergens* (Boreau) Beck in Glasn. Zemaljsk. Muz. Bosni Hercegovini 15: 210. 1903.

Lectotypus (designated here): **France. Maine-et-Loire:** Angers, champs de la Challoire, 8.V.1847, *Boreau s.n.* (ANG!) [the specimen is labelled number 4] (Fig. 2).

= *Ornithogalum paterfamilias* Godron in Mém. Soc. Emul. Doubs ser. 2, 5: 15. 1854. ≡ *O. umbellatum* subsp. *paterfamilias* (Godron) Asch. & Graebn., Syn. Mitteleur. Fl. 3: 246. 1905. ≡ *O. umbellatum* prol. *paterfamilias* (Godron) Rouy, Fl. France 12: 418. 1910. **Lectotypus** (designated here): **France. Hérault:** Cette, V.1852, *s.coll.* (NCY [010295]!).

= *Ornithogalum hortense* Jord. & Fourr., Brev. Pl. Nov. 1: 54. 1866. ≡ *O. umbellatum* var. *hortense* (Jord. & Fourr.) Rouy, Fl. France 12: 417. 1910. **Neotypus** (designated here): [Icon.] Jord. & Fourr., Icon. Fl. Eur. 1: tab. 72, n. 116. 1867 [syntypes not extant at LY].

= *Ornithogalum declinatum* Jord. & Fourr., Brev. Pl. Nov. 1: 57. 1866. ≡ *O. umbellatum* var. *declinatum* (Jord. & Fourr.) Rouy, Fl. France 3: 419. 1910. **Neotypus** (designated here): **France. Ariège:** Vieux murs à Foix (Ariège), VI-V.[18]90, *H. Sudre s.n.* (Herbier Bonaparte, LY!).

= *Ornithogalum proliferum* Jord. & Fourr., Brev. Pl. Nov. 1: 57. 1866. **Neotypus** (designated here): [Icon.] Jord. & Fourr., Icon. Fl. Eur. 1: tab. 73, n. 118. 1867 [syntypes not extant at LY].

Bulb ovoid depressed, with (7-)15-23(-35) spherical and small bulbils (5-8 mm) which are long pedicellate (pedicel 2-8 mm long), not-leaved (rarely with some weak leaf) and attached to the basal plate. *Leaves* linear to tapering, green, glabrous, with a distinct white strip on the central part. Inflorescence widely corymbose with lower pedicels very long and patent or slightly reflexed; bracts much shorter than the pedicels, the lowermost about half as long as the subtending pedicel. *Flowers* relatively large (35-45 mm of diameter) at the anthesis. *Tepals* (20-)23-28(-30) × (5-)6-8(-9) mm. *Capsule* 11-18(-20) × 7-13(-15) mm, ovate to obovate, truncate at the apex, with 6 equidistant or slightly paired ribs.

Chromosome number. – $2n$ = (36), 45, 54 (Neves, 1952, 1956; Gadella & Raamsdonk, 1981; Raamsdonk, 1986; Moret, 1992; Moret & Galland, 1992; Peruzzi & Passalacqua, 2003).

Ecology and distribution. – Cultivated and disturbed grounds in lowland and river valleys, usually on sandy soils. Mostly found in southern Europe and the western territories of the Middle East, reaching north to The Netherlands and Germany, with some disjunct populations in central-western France and Portugal (Raamsdonk, 1986). Ancient localities from North Africa (Maire, 1958) have not been recently confirmed (Pastor, 2002).

Fig. 2. – Lectotype of *Ornithogalum divergens* Boreau. **A.** *O. divergens* at ANG; **B.** Detail of the lectotype. Scale bar in cm. [*Boreau s.n.*, ANG] [© Natural science museum of Angers. Reproduced with permission]

Iconography. – Jord. & Fourr., Icon. Fl. Eur. 1: tab. 76, n. 125. 1867.

Notes. – The lectotype of *O. divergens* was chosen from amongst the syntypes (five sheets) labelled "*Ornithogalum divergens* Boreau / *O. refractum* De Notaris ! non W.K.". The original material, conserved at ANG, includes five sheets with many fragments, some of them poorly preserved, from various French and Italian localities, of which the French collections could be suitable for lectotypification. Each fragment is labelled individually from 1 to 7 on paper strips fixed with pins, that apparently correspond to the localities and dates handwritten on a label attached to one of the sheets.

On that label the following information is present:

1. "Angers pelouse au bois de la Haie 13 avril 1846 - 8 mai 1847!";
2. "Angers à Ecouflant ch. sabloneux 5 mai 1847!";
3. "Santa de la Vallée de la Loire 7 mai 1847";
4. "Angers champs de la Challoire 8 mai 1847!";
5. "Italie, Gênes prés les collines, M. de Notaris 1847";
6. "Corrège, Bainer [?] M. Loubignac";
7. "Limoges herb. Lamy".

As in the protologue of *O. divergens*, Boreau (1847) cited "Avril, mai. Pelouses, champs, lieux sablonneux. Environs d'Angers, vallée de la Loire – Limoges, etc.", individuals from localities 5 and 6 are therefore not potential lectotypes. Among the remaining specimens one labelled number 4 is designated here as the lectotype of *O. divergens*. It was collected in "Angers champs de la Challoire 8 mai 1847!". It is well-preserved and complete (including the bulb with pedicellate bulbils, leaves, and a typical inflorescence with short bracts and divergent pedicels), and hence it allows an unequivocal identification of the species.

Syntypes. – **France. Maine-et-Loire:** Angers, pelouse au bois de la Haie, 13.IV.1846-8.V.1847, *Boreau s.n.* (ANG!); Angers à Ecouflant, ch. sabloneux, 5.V.1847, *Boreau s.n.* (ANG!); Santa de la Vallée de la Loire, 7.V.1847, *s.coll.* (ANG!). **Haute-Vienne:** Limoges, s.d., *s.coll.* (herb. Lamy, ANG!).

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