

Evaluation of Linnaeus' concept of *Santolina rosmarinifolia* L. (Asteraceae, Anthemideae) and its interpretation

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ABSTRACT

The present study evaluates Linnaeus' concept of *S. rosmarinifolia*, as well as its interpretation and application. Additional original material of *S. rosmarinifolia* L. is cited and discussed. *Santolina minor* Mill., *S. linearifolia* Jordan & Fourr., *S. chamaecyparissus* L. subsp. *viridis* Rouy var. β *subintegrifolia* Rouy, *S. rosmarinifolia* f. *robusta* Sennen & Pau, and *S. rosmarinifolia* L. var. *foliosa* Sennen & Elías are lectotypified. An illegitimate name (*S. rosmarinifolia* Mill.) is identified. The current status of these names is discussed. Six names not validly published are found. The nomenclatural synonyms of *S. rosmarinifolia* are provided.

KEY WORDS

Anthemideae,
Asteraceae,
Linnaeus' names,
Santolina,
typification.

RÉSUMÉ

Évaluation et interprétation de la conception linnéenne de Santolina rosmarinifolia (Asteraceae, Anthemideae).

La présente étude examine l'espèce *S. rosmarinifolia*, telle que conçue par Linné, ainsi que son interprétation et son champ d'application. Du matériel original supplémentaire de *S. rosmarinifolia* L. est cité et commenté. *Santolina minor* Mill., *S. linearifolia* Jordan & Fourr., *S. chamaecyparissus* L. subsp. *viridis* Rouy var. β *subintegrifolia* Rouy, *S. rosmarinifolia* f. *robusta* Sennen & Pau, et *S. rosmarinifolia* L. var. *foliosa* Sennen & Elías sont lectotypifiés. Un nom illégitime (*S. rosmarinifolia* Mill.) est identifié. Le statut actuel de ces noms est discuté. Six noms n'ont pas été validement publiés. Les synonymes nomenclaturaux de *S. rosmarinifolia* sont listés.

MOTS CLÉS

Anthemideae,
Asteraceae,
noms linnéens,
Santolina,
typification.

INTRODUCTION

Linnaeus (1753) named seven species in the genus *Santolina* (subtribe *Santolininae* Willk., tribe *Anthemideae* Cass., family *Compositae* Giseke), using a broad generic concept. However, only two of them are currently recognized as members of this genus (*S. rosmarinifolia* L. and *S. chamaecyparissus* L.); the others are referable to *Athanasia* L., *Anthemis* L., and *Anacyclus* L.. De Candolle (1837) classified *S. rosmarinifolia* within the circumscription of the section *Chamaecyparissus*, whereas Jordan & Fourreau (1869) accepted seven taxa into the circumscription of the section *Rosmarinifolia*.

Persson (1807) reduced *S. minor* Mill. (Miller 1768) to a variety of *S. rosmarinifolia*, whereas Guinea (1970) reduced *S. linearifolia* Jordan & Fourr. (Jordan & Fourreau 1869) to a variety of *S. rosmarinifolia* subsp. *rosmarinifolia*.

Sennen & Pau, in Pau (1907) and Sennen & Elías, in Sennen (1929), published two names associated with *S. rosmarinifolia*: “*S. rosmarinifolia* L. var. *genuina* Pau f. *robusta* Sennen & Pau” and “*S. rosmarinifolia* L. var. *foliosa* Sennen & Elías”, respectively. Guinea (1953) assigned varietal rank to “*S. rosmarinifolia* L. var. *genuina* Pau”.

López Udías *et al.* (1997) and Greuter (2008) distinguished six and seven taxa, respectively, in the *S. rosmarinifolia* aggregate. A recent study by Rivero-Guerra (2011a), based on cytogenetic, morphological and ecogeographical characters, delimited 11 taxa in the *S. rosmarinifolia* aggregate. Rivero-Guerra (2011a) distinguished three subspecies under the circumscription of *S. rosmarinifolia*: “*rosmarinifolia*”, “*castellana*” and “*arrabidensis*”. *Santolina rosmarinifolia* L. subsp. *rosmarinifolia*, a diploid ($2n = 2x = 18$), is endemic to the Iberian Peninsula, located in the central part and running northwards, in the Occidental and Central Iberian Peninsula, at 450 to 2000 m, on a broad spectrum of substrates (Rivero-Guerra 2008b). *Santolina rosmarinifolia* L. subsp. *castellana* Rivero-Guerra, both diploid ($2n = 2x = 18$) and tetraploid ($2n = 4x = 36$), is also endemic to the central Iberian Peninsula, occupying the provinces of Ciudad Real, Salamanca, Toledo,

and Zamora. It is located in disturbed areas with great human impact, frequently growing on the embankments of highways, at 363 to 853 m, on soils derived from limestone, slate and quartzite, limestone and quartzite; conglomerates, sand, sandstone, lime and clay; marl, marl-limestone, and limestone; and limestone and marl. However, *S. rosmarinifolia* subsp. *arrabidensis* Rivero-Guerra, a tetraploid ($2n = 4x = 36, 36+1B, 36+2B$), is endemic to the Serra da Arrábida, Portugal, growing on marl-limestone and sandstone and limestone conglomerate, between 100 and 160 m. In the course of this study, nomenclatural difficulties with the first two subspecies were found and these are dealt with here.

Linnaeus did not explicitly designate holotypes for his names and rarely cited individually recognisable specimens (Jarvis 2007). Given that Linnaeus did not apply the modern type concept, holotype, paratypes and syntypes are uncommon (Jarvis 2007). Therefore, additional original material is particularly important. The lectotype of *S. rosmarinifolia* was designated by Humphries in Jarvis & Turland (1998) among all the original material: “*Herb. Linn. No. 985.2*”. The author omitted details in the lectotype selection and did not give complete details of the corresponding herbarium sheets. The same is true in Jarvis’s *magnum opus*, *Order out of chaos* (2007).

The main objects of this study are: 1) to evaluate Linnaeus’ concept of *S. rosmarinifolia* and subsequent concepts of this name; 2) to cite, evaluate and discuss additional original material of *S. rosmarinifolia*; and 3) to typify all the names available as synonyms of *S. rosmarinifolia*.

MATERIAL EXAMINED

The herbaria where the materials of Bourgeau, Jordan, Linnaeus, Miller, Pau, Persson, Rouy, and Sennen are deposited, as reported by Stafleu & Cowan (1976, 1981, 1983, 1985, 1988) were studied, as well as the collections of *Santolina* in the following pre-Linnean collections: Bauhin (BASS), Burser (UPS), Morison (OXF), Tournefort (P), Vaillant (P), and Van Royen (L).

TABLE 1. — Hypotheses, post 1753, regarding the geographical distribution of *S. rosmarinifolia*.

Author	Geographical distribution
Lamarck & De Candolle 1805; DUBY 1830; Shuttleworth <i>et al.</i> 1889.	France
Poiret 1805; Losco Bernal & Pardo Sastrón 1866-1867. Persson 1807.	France and southern Europe Spain
De Candolle 1837. Boissier 1840.	Southern Europe, France, Iberian Peninsula and Naples Centre, east and west of the Iberian Peninsula
Willkomm 1852. Nyman 1854-1855.	Centre and north of the Iberian Peninsula Centre, west and south of the Iberian Peninsula, Italy and north of África
Arcangely 1882. Colmeiro 1887; Lázaro é Ibiza 1907, 1921.	Italy Mountains of centre, south, east (only Colmeiro 1887) and west of the Iberian Peninsula
Gandoger (1917).	North, northwest, centre, west and south of the Iberian Peninsula
García Rollán 1981; Sagredo 1987	Iberian Peninsula and south of France

LINNAEUS' CONCEPT OF *S. ROSMARINIFOLIA* AND ITS INTERPRETATION

PROVENANCE AND GEOGRAPHICAL DISTRIBUTION

The indication of the location of *S. rosmarinifolia* by Linnaeus in *Hortus Cliffortianus* is exhaustive (1738: “*Santolina foliis linearibus, pedunculis unifloris*”: “*Crescit in agro Salmanticensi & montibus Segobiae vicinis, qui Castellam novam a veteri separant, aliisque asperi & salebrosis Hispaniae locis*”) whereas in *Species Plantarum* (Linnaeus 1753, 1763, 1764: “*Habitat in Hispania*”) it is ambiguous: he reduces the location of *S. rosmarinifolia* to “Hispania” exclusively. The locality described in the earlier text is similar to the *locus classicus* of *Abrotanum foemina salmantiensis* I and II (Clusius 1576), and *Abrotanum foemina* IV, V and VI (Clusius 1601) “*Nascuntur in Salmanticense agro, montibus Segobiae vicinis, quos el Puerto de Guadarrama vocant, et veterem Castellam a Nova separant, aliisque asperi et salabrosis Hispaniae*”. Obviously, Linnaeus cited the *locus classicus* of *Abrotanum foemina salmantiensis* I and II, but he omitted the work of Clusius. Unfortunately, no specimen from these localities has been conserved in BASS-BAUHIN.

Linnaeus did not study Clusius' herbarium. The works of Clusius have no illustration of this species. The specimens of *S. rosmarinifolia* from the collections of van Royen and Cliffort, were from

plants cultivated in the Botanical Garden of Leiden and in Cliffort's garden, respectively. Probably, these specimens derived from achenes of *Abrotanum foemina salmantiense* plants cultivated by Clusius in the Belgium Botanical Garden (Dr G. López González, CSIC, pers. comm.). If this hypothesis was true, the type material of *S. rosmarinifolia* would be from the mountains of Salamanca or Segovia provinces or from the *Sierra de Guadarrama* (Madrid and Segovia provinces). However, it is not possible to demonstrate this.

Furthermore, no symbol quoting the life form of this species was cited by Linnaeus (1738, 1753).

Reichard (1780), Jolyclerc (1798), Willdenow (1803), and Sprengel (1826) accept the definition of *locus classicus* proposed by Linnaeus for this species.

The geographical distribution of *S. rosmarinifolia* has been discussed by botanists (Table 1). Boissier (1840) explained that it has been cited erroneously in France and Italy “*In Galloprovincia et Italiâ per errorem indicatâ*”. Analogous comments were cited by Fiori & Béguinot (1903-1904), who suggested that *S. rosmarinifolia* had been cited erroneously in “*Napoletano*”. The specimen of *S. rosmarinifolia* (LY-ROUY) gathered by Bourgeau in 1879, has the erroneous locality “*Bords des Champs à Menton (Alpes-Marit.)*”. The same is true for the specimen gathered by Funk (VIII.1818) in “*Sierra Nevada in regionis montanae collibus aridis*”, currently accepted into the circumscription of the hybrid swarm

TABLE 2. — List of synonyms of *Santolina foliis linearibus* L., *S. pedunculis unifloris* L. and *S. rosmarinifolia* published by Linnaeus (1738, 1753, respectively).

Hortus Cliffortianus (1738)	Species Plantarum (1753)
1. <i>Santolina foliis linearibus, pedunculis unifloris</i> <i>Santolina vermiculata cretica</i> (Tournefort 1719; Vaillant 1719; Pontedera 1720) <i>Santolina, foliis rosmarini, major</i> (Tournefort 1719; Boerhaave 1727) <i>Abrotanum femina, foliis rosmarini, majus</i> (Bauhin 1623; Morison 1699)	2. <i>Santolina rosmarinifolia</i> <i>Santolina foliis linearibus, pedunculis unifloris</i> (Linnaeus 1738; van Royen 1740) <i>Abrotanum femina, foliis rosmarini, majus</i> (Bauhin 1623; Morison 1699)
<i>Abrotanum femina</i> 4 (Clusius 1601)	<i>Abrotanum femina</i> 4 (Clusius 1601)
α. <i>Abrotanum femina, foliis rosmarini, minus</i> (Bauhin 1623)	β. <i>Abrotanum femina, foliis rosmarini, minus</i> (Bauhin 1623)
β. <i>Santolina vermiculata cretica</i> (Tournefort 1719; Vaillant 1719)	γ. <i>Abrotanum femina viridis</i> (Bauhin 1623)
γ. <i>Abrotanum femina viridis</i> (Bauhin 1623)	δ. <i>Abrotanum femina, flore majore</i> (Bauhin 1623)

S. x oblongifolia Boiss., *nothosp.* *S. x oblongifolia*, is endemic to the mountains of Gredos, Bejar, Candelario and Tormantos in the provinces of Ávila and Cáceres.

THE DIAGNOSIS

Santolina rosmarinifolia was published by Linnaeus in 1753 with the following phrase-name appended to the generic name: “*I. SANTOLINA pedunculis unifloris, foliis linearibus*”. The diagnosis is accompanied by references to his work, *Hortus Cliffortianus*, and the work of Van Royen (1740), *Florae Leydensis Prodrromus*. The order of the names in *Hortus Cliffortianus* (Linnaeus 1738) is inverted in *Species Plantarum* (1753), name “1” in *Hortus Cliffortianus* becoming name “2” in *Species Plantarum*.

The diagnostic characteristics evolved from Linnaeus’ earlier treatment in *Hortus Cliffortianus*, but the order of the characters in the diagnosis in *Hortus Cliffortianus* (Linnaeus 1738: *Santolina foliis linearibus, pedunculis unifloris*) is inverted in the first edition of *Species Plantarum* (Linnaeus 1753: *Santolina pedunculis unifloris, foliis linearibus*). In *Systema Naturae* (Linnaeus 1759, 1767), Linnaeus added “*marginē tuberculatis*” at the end of the diagnosis. Linnaeus (1763, 1764) added four lines with the following diagnostic characters below the *locus classicus* “*Herba vix suffruticosa. Folia margine utroque bifariam tuberculis crenulata, sed in caule florescente*

linearia, ad apicem utrinque denticulate. Pedunculi longi, terminales, uniflori”. Linnaeus’ concept of *S. rosmarinifolia* persisted unaltered after the publication of the edition of *Systema Naturae* in 1759.

Linnaeus’ concept of *S. rosmarinifolia* was quickly recognised by many of Linnaeus’ contemporaries (e.g., Reichard [1780], Murray [1784], Paláu y Verderá [1787], Gilibert [1789], Gmelin [1796], Murray & Persson [1797], Brotero [1804], Poiret [1805], and finally Gussone [1843]). Jolyclerc (1798) added the phrase “*tuberculées sur les bords*” (separated by a comma) at the end of his diagnosis of this name.

Willdenow (1803) added the following diagnostic characteristics: “*S. pedunculis unifloris, foliis linearibus, inferioribus subpubescentibus margine tuberculatis, superioribus planis integerrimis glabris, ramis calycibusque glabris*”. The specimens B-W 15281-000 (folder), 15281-010, and 15281-020 fully match *S. rosmarinifolia sensu stricto*, whereas the specimen B-W 15281-030 is *S. impressa*. Persson (1807), Deslongchamps (1807), Duby (1830), and Cutanda (1861) accepted the changes proposed by Willdenow (1803). However, Sprengel (1826) modified the diagnosis of *S. rosmarinifolia* (“*S. foliis linearibus, inferioribus fasciculatis incanis margine tuberculatis, superioribus planis integerrimis viridibus, caule suffruticoso ramosissimo, pedunculis 1floris*”) as suggested by Willdenow (1803).

Duby cited *Abrotanum foemina, foliis longis viridibus* (Duby 1830: fig. 22, série 6, table 3; Morison 1969) as a synonym of *S. rosmarinifolia*. Examination of OXF-Morison's collection indicates that the specimen labelled as *Abrotanum foemina viridis* (Morison 1969: part III, p. 12, n. 22) is *S. rosmarinifolia*.

De Candolle (1837) was the first to include the shape of the involucre bracts, the presence of carinate bracts, and the presence of scarious appendage in the diagnosis of *S. rosmarinifolia*: "*invol. squamis glaberrimis subcarinatis acutis, intimis apice subscariosis*". Willkomm & Lange (1865) added two quantitative characters (length of the flowering stems and diameter of the capitulum) and gave a detailed description of the shape of the bracts, and the shape and incision of the appendage of the outer and inner bracts. Sampaio (1946) cited the presence of leaves with margin involute addressed as a good diagnostic character for this species.

Guinea (1970) and Guinea & Tutin (1976) published a synthesis of the qualitative characteristics for this name, the latter adding the length of the flowering stems as a new diagnostic character. Amaral Franco (1984) published the most complete description of *S. rosmarinifolia*, based on quantitative and qualitative characteristics, which was summarized by López Udías *et al.* (1997).

THE SYNONYMS: LINNAEUS' CONCEPT

Linnaeus (1738) published *Santolina foliis linearibus, pedunculis unifloris* followed by seven synonyms (Table 2). He cited *Santolina vermiculata cretica*, in two instances; he included reference to Pontedera (1720) in the first, but no such reference was made in the second (Table 2). This phrase name, together with the phrase name *Santolina, foliis rosmarini, major* were omitted in *Species Plantarum*. Linnaeus (1753) gave a new *nomen specificum legitimum* followed by six synonyms (Table 2). He accepted, in *Species Plantarum*, four of the seven synonyms cited in the *Hortus Cliffortianus*, adding "*δ. Abrotanum femina, flore majore*. Bauh. Pin. 137". This phrase name was not cited in *Hortus Cliffortianus*. Two varieties show the following inversion: var. α in *Hortus Cliffortianus* becomes var. β in *Species Plantarum*. Linnaeus (1763, 1764) added the phrase-name "*foliis villosis & incanis*" (separated by a comma) at

the end of the phrase-name "*δ. Abrotanum femina, flore majore*". Bauhin (1671: reprint of *Theatri Botanici*) inverted the order of the names published into the genus *Abrotanum* (Table 2). The absence of *Abrotanum foemina flore majore* in the edition of 1671 is indirect evidence that Linnaeus cited the first edition (1623) of this work.

Examination of the BASS-Bauhin herbarium indicates that the specimens labelled as "*IX. Abrotanum foemina viridis / Abrotanum foemina foliis rosmarini majus*" and "*X. Abrotanum foemina foliis rosmarini majus / Abrotanum foemina foliis rosmarini minus*" are *S. canescens*, whereas the specimen named as "*II. Abrotanum foemina flore majore / Abrotanum foemina flore majore, foliis villosis & incanis*" is *S. chamaecyparissus*. The specimen labelled as *Abrotanum foemina foliis majore Bauh. // Abrotanum foemina III ---- Narbonensis Clus. Hist. 342 // In Gallo provincia sponti: in Horto Regio Parisiense* (UPS-BURSER-7-1-42) is also *S. chamaecyparissus*. Bauhin (1623, 1671) cited the names published by Clusius (1601) with the number 4, 5 and 6 into the synonymy of "*Abrotanum foemina, foliis rosmarini majus*", "*Abrotanum foemina, foliis rosmarini minus*", and "*Abrotanum foemina viridis*", respectively. He also cited *Abrotanum foemina* 3 Clus. as a synonym of "*Abrotanum foemina flore majore*". The names published by Clusius (1601) with the number 1-3 and 5 are *S. chamaecyparissus*.

The specimen labelled by Morison as *Abrotanum foemina foliis rosmarini majus* (Morison 1969: part. III, p. 12, n. 20) does not differ from *S. virens* Mill. *sensu stricto*. However, the specimen labelled as *Abrotanum foemina viridis* (Morison 1969: part III, p. 12, n. 22), currently accepted as *S. rosmarinifolia*, was not cited by Linnaeus (1738, 1753) as a synonym of this name.

No specimen labelled as *Santolina vermiculata cretica* is conserved in P-Tourn. Vaillant (1719) cited "*Santolina foliis rosmarini, major*" (P, P-TOURN 4215) as a synonym of "*Santolina vermiculata cretica*" suggesting that both names are synonyms. Probably, Vaillant used the material from Tournefort's herbarium. However, both Vaillant (1719) and Linnaeus (1738, 1753) excluded "*Santolina rosmarinifolia minor*" (P, P-TOURN 4216) as a synonym of *S. rosmarinifolia*. Pontedera (1720) accepted

Tournefort's classification (1700, 1719). However, both Tournefort & Jolyclerc (1797) excluded "*Santolina vermiculata*, *Cretica*", "*Abrotanum vermiculatum*, *Creticum*" (P-TOURN 4217), "*Santolina repens* & *canescens*", and "*Santolina foliis obscure virentibus*, *flore sulfurei coloris*" (P-TOURN 4214) from the circumscription of this genus. Boerhaave (1727) accepted "*Santolina, foliis rosmarini, major*" (P-TOURN 4215) as a good name, and cited "*Abrotanum femina, foliis rosmarini, majus*" (Bauhin 1623) and "*Abrotanum femina* 4" (Clusius 1601) as its synonyms.

Van Royen (1740) accepted two names into the synonymy of *Santolina foliis linearibus, pedunculis unifloris* (*Santolina, foliis rosmarini, major* [Tournefort 1700, Boerhaave 1727] and *Santolina vermiculata cretica* [Tournefort 1700, Vaillant 1719, Pontedera 1720]). Four specimens (L 0053124, 0053125, 0053126, 0144036) are preserved in the folder of *Santolina* in L-Royen; only two of them are currently delimited as *Santolina* (L 0053124 [*S. chamaecyparissus*], 0053126 [*S. rosmarinifolia*]).

One specimen of *S. rosmarinifolia* is preserved in the BM-Cliff (BM-CLIFF 000646963: *Abrotanum femina viridis* | *Santolina foliis obscure virentibus, flore sulfurei coloris* | *Santolina rosmarinifolia* γ | *Santolina* 1 γ) and Linn (LINN-985.2) herbaria. No specimen of this species is conserved in UPS-Burser.

INTERPRETATION OF LINNAEUS' CONCEPT

Paláu y Verderá (1787) accepted the synonyms of *S. rosmarinifolia* proposed by Linnaeus (1753). He changed the order of α , β , γ , excluding " δ ".

Reichard (1780) included three new synonyms: "*S. pedunculis unifloris, capitulis globosis, foliis linearibus integerrimis*. Mill. dict. n. 5. R", "*Abrotanum foemina, foliis rosmarini, minu*. Bauh. pin. 137. Kniph. cent. n. 80", "*Santolina (minor) pedunculis unifloris, foliis linearibus confertis obtusis*. Mill. dict. n. 6. R.", and "*Santolina (villosa) pedunculis unifloris, calycibus globosis, foliis quadrifariis dentatis tomentosus*. Mill. dict. n. 2". Reichard also added "*Willich. obs. n. 125*" to the list of references cited by Linnaeus. In addition, he cited the following characteristics at the end of the phrase-name: "*Santoline avec une fleur sur chaque pédoncule, et des feuilles linéaires, obtuses,*

et rassemblées en paquets". Gilibert (1789), Willdenow (1803), and Sprengel (1826) accepted the synonymy published by Reichard (1780). However, Willdenow (1803) excluded " γ . *Abrotanum femina viridis*" (Bauhin 1623), " δ . *Abrotanum femina, flore majore, foliis villosis & incanis*" (Bauhin 1623) and "*S. villosa*" (Miller 1768), whereas Sprengel (1826) added two new synonyms: "*S. ericoides* Poir." and "*S. canescens* Lag.". Furthermore, Gmelin (1796) cited "*Moris. hist. pl. 3. t. 3. f. 22*" at the end of the diagnosis.

De Candolle (1837), Webb (1838, 1853), Boissier (1840), Cutanda & Amo (1848), Colmeiro (1849), Willkomm (1852), Cutanda (1861), Lange (1861), and Texidor y Cox (1869) accepted *S. rosmarinifolia* Mill. (Miller 1768) as a good name. De Candolle (1837) cited *S. rosmarinifolia* L. as a synonym of *S. rosmarinifolia* Mill; the opposite was suggested by Reichard (1780).

Willdenow (1803), Poiret (1805), and De Peñafort Malagharriga Heras (1980) considered *S. minor* (Miller 1768) as a synonym of *S. rosmarinifolia*, whereas De Candolle (1837) and Steudel (1841) cited *S. minor* as a synonym of *S. canescens*.

Salisbury (1796) cited *S. rosmarinifolia* as a synonym of *S. variifolia nomina ambigua*; it was published without plate, diagnosis or description. No specimen labelled with this name is preserved in any of the herbaria studied.

Poiret (1805), Lamarck & De Candolle (1805), Duby (1830), De Candolle (1837), Steudel (1841), Willkomm & Lange (1865), Del Amo y Mora (1872), Colmeiro (1887), De Mariz (1894), De Peñafort Malagharriga Heras (1980), and Ladero Álvarez *et al.* (1985) cited *S. tuberculosa* Lamk. into the synonymy of *S. rosmarinifolia*. De Peñafort Malagharriga Heras (1980) also cited *S. linearifolia* as a synonym of *S. rosmarinifolia*.

Rouy (1903) accepted *S. rosmarinifolia* as a synonym of *S. chamaecyparissus* L. subsp. *viridis* (Willd.) Rouy var. β *subintegrifolia* Rouy.

Furthermore, Mateo Sanz (1990) considered *S. ageratifolia* Barnades ex Asso and *S. longidentata* Pau as synonyms of *S. rosmarinifolia*. Rivero-Guerra (2008a) demonstrated that *S. ageratifolia* is a good species. She cited *S. longidentata* as its synonym (Rivero-Guerra 2011b).



Fig. 1. — Specimen of *S. rosmarinifolia* L. (L. 0053126) preserved in the herbarium of A. van Royen.

TYPIFICATION

1. *Santolina rosmarinifolia* L.
subsp. *rosmarinifolia*

Species Plantarum II: 842 (1753). — Type (as given in the protologue): “Habitat in Hispania”. — Lecto-, (designated by Humphries in Jarvis & Turland *in Taxon* 47: 365. 1998): “2 *rosmarinifolia*” (handwritten graphite notation in the centre of the lower margin), and “985.2” (graphite notation in the centre of the upper margin). (Herb. Linn. n° 985.2 [LINN: <http://www.linnean-online.org/9989>]).

REMARKS

Three specimens are potentially original material of *S. rosmarinifolia*: LINN 985.2, BM-CLIFF 000646963 (see Appendix) and L 0053126 (Fig. 1). The lectotype is quite typical and annotated with “*rosmarinifolia*” by Linnaeus (LINN 985.2). It is a sample with three sterile stems and two flowering stems with one and two axillary branches respectively, all of them with immature heads.

Stearn (1957) explained the connection between the number on the sheets of the Linnean herbarium and the number that Linnaeus used for each species in the first edition of *Species Plantarum*. He suggested that the presence of these numbers is indicative that the collection was in Linnaeus’ possession prior to 1753. The specimen of *S. rosmarinifolia* from Linnaeus’ herbarium, particularly, shows that the two numbers match.

The specimens from Clifford’s herbarium (BM-CLIFF 000646963) were used by Linnaeus to prepare *Hortus Cliffortianus* in 1738. Linnaeus spent the winter of 1737-1738 in the Botanical Garden of Leiden, invited by van Royen, the director of this institution, assisting in preparing a new system for the arrangement of the Hortus (Jarvis 2007). Probably, he also examined van Royen’s collection prior to 1753. Therefore, these two collections are also original material of this species.

S. rosmarinifolia Mill.

Garden Dictionary n. 5 (1768) “*nom. illegit.*”, c.f. Article 53.1 of the ICBN, McNeill *et al.* 2012”.

REMARKS

Miller (1768) described *S. rosmarinifolia* (BM 000909660) as: “*pedunculis unifloris, capitulis globosis, foliis linearibus integerrimis*”, and assigned it the number 5. He also cited “*Santolina foliis rosmarini major*” (P-TOURN 4215) as a synonym of this name. It is illegitimate due to homonymy (c.f. Article 53.1 of the ICBN, McNeill *et al.* 2012) with the legitimate name *S. rosmarinifolia* (Linnaeus 1753).

S. minor Mill.

Garden Dictionary n. 6. (1768). — *S. rosmarinifolia* L. var. β *minor* (Mill.) Persoon. Syn. pl. 2: 406. 1807. — Ind. Loc.: without locality, collector and date. — Lecto-, (designated here): “[P. Miller] (graphite)/an Santolina foliis rosmarini minor Inst [black ink]”; “Santolina minor M. Dict. [graphite]”; “_____ *rosmarinifolia* L.?” [graphite]; “ex herbaris Di Gronovii. 1729”; “Obs. Folia inferiori/margine imbricato superi integerrimis” [graphite notation to the right of the original sample]; “*Santolina minor* Miller 1768. [handwritten notation in blue ink] / Dct. n. 6 [handwritten notation in blue ink] / Type specimen [printed and framed in black ink]/teste Solander: bud Miller says “An....” (BM 000909713).

REMARKS

The lectotype (BM 000909713) is the sole original material for this name and it is very poorly preserved. It has a flowering stem in the centre of the sheet, with a sterile stem on both sides. The lectotype displays the characteristics listed in the protologue “*Pedunculis unifloris, foliis linearibus confertis obtusis*”. Miller (1768) cited “*Santolina foliis rosmarini minor*. Tourn. Inst. 461” as its synonym, whereas in 1785 he added “*Abrotanum femina, foliis rosmarini, minu.* Bauh. pin. 137. Kniph. cent. n°. 80” as a new synonym.

S. linearifolia Jord. & Fourr.

Icones ad Floram Europae novo fundamento instaurandam spectantes 1:12 (1872). — *S. rosmarinifolia* L. subsp. *rosmarinifolia* var. *linearifolia* (Jord. & Fourr.) Guinea, *Anales Instituto Botánico de Cavanilles* 22: 39/1970. — Type (as given in the protologue): “Hispania. Gerte prope Placencia”. — Lecto-, (designated here): “Bords de la rivière à Gerte près Placencia, 17.VI.1863, Bourgeau 2538” (LY-Jordan, Fig. 2).



FIG. 2. — Lectotype of *S. linearifolia* Jord. & Fourr. (LY-Jordan).

REMARKS

The lectotype (LY-Jordan) is a large sample with several flowering stems with immature heads. This specimen is labelled by Bourgeau as *S. rosmarinifolia* Mill. It has Jordan's notation indicating "linearifolia". This sheet is also labelled by D. Rivera as "Santolina linearifolia [underlined] Jord. et Fourr. // LECTOTYPUS [underlined] // 18-10-1984". It has the following stamp: "HERBIER JORDAN // Faculté Catholique Lyon // dep. in LY".

Two specimens (LY-JORDAN, "1^{ère} feuille" and "2^{ème} feuille") from "Placencia, 1863, Bourgeau s. n., jard. VII.1868, Jordan" are labelled as *S. linearifolia*, one of them with the following notation by D. Rivera: "Santolina linearifolia [underlined] Jord. et Fourr. // TYPUS [underlined]". However, it does not match the *locus classicus* of this name.

The further five specimens of *S. linearifolia* with the number 3951, gathered by Jordan in July (1868, 1869) in the Botanical Garden of Lyon, are preserved in LY-BONAPARTE. Three of them are from Placencia, and the others have no locality. Another specimen is preserved in LY-GANDOGGER: "Cáceres: Plasencia (Espagne), Cult. À Lyon, fl. 9 juillet 1869". The specimens of *S. linearifolia* from the collections of Bonaparte, Gandoger and Jordan evolved from achenes cultivated in the Botanical Garden of Lyon from the original collection of Bourgeau.

The specimen from Placencia (LY-JORDAN, MPU) was labelled as *Santolina linearifolia* and cultivated in the Botanical Garden of Lyon "Cult. à Lyon / fl. 9 juillet 1869". This sheet has other label with the following handwritten notation of "D. Rivera": "¿¿¿ Santolina linearifolia Jord. et Fourr. ??? // ?? // ¿Confusion d'étiquette? // voir icônes n° 236 (double underlined) // 18-10-84". This specimen is the same as *S. chamaecyparissus* from the Pyrénées mountains.

The specimens show the characteristics listed in the protologue "*S. capitulis hemisphaericis, crassiusculis; involucri concavi, basi subtruncata umbilicati, glabri foliolis lanceolatis, acuminatis, dorso valde carinatis, interioribus praesertim superne margine scarioso subrotundato lateraliter producto lacero-denticulato latiuscule cinctis; flosculis vivide luteis, exterioribus geniculato recurvis involucri omnino*

occultantibus; foliis numerosis, suberectis erectisve, anguste linearibus, acutis, supra medium bifariam laxe brevissimeque tuberculato-denticulatis, superioribus integris, glabris, viridulis, caulium hornotiorum cinereo-glauciscentibus axillaribus conspicue brevioribus erecto-adpressis; caulibus elongatis, erectis vel basi leviter ascendentes, striatis, glabris, apice nudis plerumque monocephalis sed tamen ramulos graciles nonnunquam gerentibus, e caudice ramoso fruticoso productis".

S. chamaecyparissus L. subsp. *viridis* Rouy
var. β *subintegrifolia* Rouy

Flore de France 8: 224 (1903). — *S. rosmarinifolia* L. var. *viridis* (Willd.) Guinea, *Anales Instituto Botánico de Cavanilles* 22: 39 (1970) "comb. illegit. c.f. Art. 52 of the ICBN, McNeill *et al.* 2012". — Type (as given in the protologue): "Alpes-Maritimes: bords des champs à Menton (Hanry in H. R., sub *S. rosmarinifolia*) – Souvent cultivé et échappé de jardins". — Lecto-, (designated here): "Bords des champs à Menton (Alpes-Marit), VI.1879, Hanry" (LY-ROUY, Fig. 3).

REMARKS

Willdenow (1803), in the protologue of *S. viridis*, cited *S. virens* Mill. as its synonym. Therefore, *S. viridis* Willd. is a superfluous and illegitimate name (c.f. Art. 52 of the ICBN, McNeill *et al.* 2012). The epithet *viridis* was combined at subspecies rank under *S. chamaecyparissus* by Rouy (1903). *Santolina chamaecyparissus* L. subsp. *viridis* Rouy (Rouy 1903) could be legitimate and treated as a *nomen novum* under Art. 55.2 and 58.1 of the ICBN (McNeill *et al.* 2012). The correct author citation for *S. chamaecyparissus* L. subsp. *viridis* published by Rouy (1903) by reference to *S. viridis* "Willd." is therefore "Rouy", not "(Willd.) Rouy".

The "Alpes-Maritimes" are not the natural habitat of *S. rosmarinifolia*. Rouy used a cultivated plant to describe this name. The lectotype (LY-Rouy) is a single sample showing a woody branch bearing four flowering stems with mature heads, four immature flowering stems and two vegetative stems. It is labelled by Hanry as "*S. rosmarinifolia*". The sheet has two stamps: "HERBIER ROUY [in the



Fig. 3. — Lectotype of *S. chamaecyparissus* L. subsp. *viridis* Rouy var. β *subintegrifolia* Rouy (LY-ROUY).

right-hand margin, above the label]” and “LY [to the left of the label]”. One other sheet from the type locality “Menton. Frontière d’Italie et de France. L. Chevallier, Précigné”, without collection data, is conserved in P. These specimens have the characteristics listed in the protologue: “*Feuilles entières ou lâchement denticulées; calathides plus grandes (15-17 mill. de diam.)*”.

Guinea (1970) reduced *S. viridis* Willd. to a variety of *S. rosmarinifolia* subsp. *rosmarinifolia*, based on plants from Placencia, characterised by “*caulibus sat elongatis, erectis, leviter striatis, glabris; involucris glabris*”. As previously explained, *S. viridis* is a superfluous and illegitimate name. The combination *S. rosmarinifolia* L. var. *viridis* published by Guinea (1970) is also illegitimate because the author cited Willdenow, not Rouy, as author of the epithet “*viridis*”.

Three specimens (G, two specimens with the number 2538 and the other without a number) from *Hauts de la Rivière de la Vallée de Gerte près Placencia* are labelled by Guinea as *Santolina (viridis) virens* Miller. Two of them fully match *S. rosmarinifolia* subsp. *rosmarinifolia*, whereas the other is *S. x oblongifolia*.

S. rosmarinifolia L. var. *genuina* Pau ex Guinea

In Pau, *Boletín de la Sociedad Aragonesa de Ciencias Naturales* 6: 25 (1907) “*nom. inval.*, c.f. Art. 24.3 of the ICBN, McNeill et al. 2012”.

REMARKS

Pau (1891) wrote: “*Santolina canescens* Lag. = *S. rosmarinifolia* L. *genuina*”. The same author (1907) published “*Santolina rosmarinifolia* L. *genuina* Pau pl. exs. (1905)” without rank and diagnosis (MA 126700: “Mancilla, V.1905, Pau”). Other specimens from the *locus classicus* (PO 50776, 50777 [9.VII.1905], and E 00231985, MPU [8.VII.1905]) have different collection data. Guinea (1953) assigned it a varietal rank, whereas Carrasco de Salazar (1975) and Escriche (1975) confirm it. However, the epithet “*genuina*” is not validly published in accordance with Art. 24.3 of the ICBN (McNeill et al. 2012).

S. rosmarinifolia L. f. *robusta* Sennen & Pau

In Pau, *Boletín de la Sociedad Aragonesa de Ciencias Naturales* 6: 25. 1907. — Type (as given in the protologue): “Bujedo (Sennen et Elías)”. — Lecto-, (designated here): “Castille: Bujedo, talus, VI.1906, *Sennen & Elías s.n.*” (MA 126701).

REMARKS

Sennen & Pau in Pau (1907) published “*S. rosmarinifolia* L. *genuina* Pau f. *robusta* Sennen & Pau”, without rank for “*S. rosmarinifolia* L. *genuina* Pau”. As previously explained, the ICBN rejects the use of the epithet “*genuina*”. *Santolina rosmarinifolia* L. f. *robusta* Sennen & Pau could be legitimate and treated as a *nomen novum*. The sheet (MA 126701) is the sole original material for this name. It has several flowering stems. Sennen labelled this specimen as “*S. rosmarinifolia*”. Pau, in an additional label, wrote: “(var) *a genuina f^a robusta* [underlined] S. et P.”

The specimens A 00251691, BC 30112, BM 000909706, G-BURNAT, MA 126699, MANCH, MPU (2 sheets), UCLA and W from “*Bujedo et Miranda, talus*” with the number “*N^o 79*”, gathered by Sennen and Elías on “VI.1906”, are labelled as *Santolina rosmarinifolia* L. var. *genuina*. Another specimen from “*Bujedo, Miranda del Ebro*”, gathered by Elías on “26.VI.1906”, is deposited in MPU. These specimens show the characteristics listed in the protologue: “*Folia latiora et longiora, crassiuscula. Pl. Major*”.

S. rosmarinifolia L. var. *foliosa* Sennen & Elías

In Sennen, *Boletín de la Sociedad Ibérica de Ciencias Naturales*, n^o 4338 (28): 30 (1929). — Type (as given in the protologue): “Burgos: Vitoria de Rioja, Montagnes, vers 900 m. Leg. Hno. Elías”. — Lecto-, (designated here): “Burgos: Vitoria de Rioja, montagnes, 14.VII.1921, *Elías 4338*” (BC-SENNEN 831809, Fig. 4); isolecto-, BC-SENNEN 831809, BM 000909628, L 0653119, MA 52162, 126698, MPU, W.

REMARKS

The lectotype (BC-SENNEN 831809) has two samples and two labels. The sample on the left has eight



FIG. 4. — Lectotype of *S. rosmarinifolia* L. var. *foliosa* Sennen & Elias (BC-SENNEH 831809).

flowering stems. The sample on the right has three sterile stems. They are labelled as “*S. rosmarinifolia* L. var. *foliosa* Sen. et Elías”. The lectotype has an elliptical stamp in blue ink in the lower left-hand corner, indicating: “HERBARIUM INSTITUTUM BOTANICUM BARCINONENSIS BC-SENNEN/831809”.

The specimens have the characteristics listed in the protologue “*Calathidio periclinio haud concavo; folia densa, viridi-obscura. // Calathides presque petites, un peu moins que dans la var. cinerea Pau et Merino, de péricline à évasée; feuillage d'un vert sombre, dense*”.

Other synonyms of *S. rosmarinifolia* not validly published are: *S. rosmarinifolia* L. f. *glabra* Gdgr., *nom. in sched.*, *S. rosmarinifolia* L. var. *trichroma* Sennen, *nom. in sched.* and *S. rosmarinifolia* L. var. *v.* form. *oretana* Gómez, Ladero & Rivas Goday, *nom. in sched.* (the authors wrote “*v.*”, probably indicates “*virens*”).

2. *Santolina rosmarinifolia* L. subsp. *castellana* Rivero-Guerra

Systematic Botany 36: 171-190. 2011. — Type (as given in the protologue): “Salamanca: Castellanos de Villiquera, 41°02'65”N, 5°40'52”W, 800 m, on limestone and quartzite, 10.VII.1998, A. O. Rivero-Guerra *s.n.* (holotype, SEV 239491).

S. rosmarinifolia L. f. *glaucescens* Bourgeau, *nom. in sched.*

S. rosmarinifolia L. f. *pubescens* Bourgeau, *nom. in sched.*

S. pectinata Lag. subsp. *canescens* var. *subpectinata* Borja, non *S. pectinata*, non *S. canescens* (Lagasca, 1816), *nom. in sched.*

REMARKS

Nyman's concept (1879) of *S. rosmarinifolia* was based on the specimens gathered by Welwitsch and Bourgeau: “*Santolina rosmarinifolia* L. – Exc. Welw. Lusit. 110. cont. 186. Bourg. Hisp. a. 1851. 2356. etc.- 1863. 2538. 2539 (var. *glaucescens*). Lusit. Hisp. (praec. centr., mer.)”. The specimens from “*Sierra Nevada, région chaude, près Guejar de la Sierra, 27.VI.1851, Bourgeau 2356*” (COI 00035970, G, LIV 1974.38.88718, MANCH, MPU, P [4 sheets]) are *S. canescens*. Conversely, the specimens gathered by Welwitsch, and labelled with the numbers 110

(BM 000909648, G-BURNAT, G [2 sheets], HAL 103776, HEID, L 0653134, MPU, P [3 sheets]) and 186 (G, P) are *S. rosmarinifolia* subsp. *arrabidensis*. The specimens from “*Bords de la rivière à Gerte près Placencia, 14.VI.1863, Bourgeau 2538*” are *S. rosmarinifolia* subsp. *rosmarinifolia* (G [3 sheets]), and *S. x oblongifolia*. (G, MANCH, MPU, P [3 sheets]). The specimens from “*Hauts de rivière de la vallée de Gerte près Placencia, 17.VI.1863, Bourgeau 2539*” are *S. rosmarinifolia* subsp. *rosmarinifolia* (G [4 sheets], JE [2 sheets], MA 126712, MANCH, MPU, P [4 sheets], W), *S. rosmarinifolia* subsp. *castellana* (COI 0035990, MPU, W [2 sheets]), and *S. x oblongifolia*. (G). The specimen (A 00251703) from “*près Placencia, Bourgeau 2539*” is *S. rosmarinifolia* subsp. *rosmarinifolia*. There is another specimen with this number, without locality, in P (*S. x oblongifolia*). This indicates that Nyman had a broad concept of the *S. rosmarinifolia* name.

Two specimens of *S. rosmarinifolia*, gathered by Lacaita in *Val Amblés (Ávila)* are labelled as “*Santolina rosmarinifolia* L. forma *candidior foliis minute serrulatis*” (BM 000909685) and “*Santolina rosmarinifolia* L. forma *foliis integris atroviridibus*” (BM 00090967). Furthermore, the specimens BM 000909673 and COI 00035990 gathered by Lacaita (Granada, Sierra Elvira) and Bourgeau (*Hauts de rivière de la vallée de Gerte près Placencia*) are labelled as “*Santolina canescens* Lag. forma fl. *pallior citrinis*” and “*S. rosmarinifolia* L. *α vulgaris* Boiss. forma *glaucescens, glaberrima*”, respectively. These names have been rejected under Article 23 of the ICBN (McNeill *et al.* 2012).

DISCUSSION

In July 1736, Linnaeus travelled to London and Oxford (Jarvis 2007). He visited the Oxford herbarium, where he probably examined Morison's collection. Linnaeus visited the Botanic Garden of Leiden during the winter of 1737-1738. Probably, he also examined van Royen's collection. He also received duplicates from van Royen of cultivated plants later enumerated in the *Florae Leydensis Prodrromus* (1740; see Stearn 1957). In May 1738, he visited the Paris herbarium and examined the

collections of Tournefort and Jussieu (Jarvis 2007), and perhaps, in addition, Vaillant's collection. The specimens of *Santolina* in Bauhin's collections were not examined by Linnaeus in preparing *Hortus Cliffortianus* and *Species Plantarum*. He used Burser's herbarium (over 3,000 sheets arranged according to Bauhin's *Pinax Theatri Botanici* [1623]) as a voucher collection for the interpretation of Bauhin's names (Jarvis 2007).

Examination of the original material of the names cited by Linnaeus (1738, 1753, respectively) as synonyms of "*Santolina foliis linearibus, pedunculis unifloris*" and "*S. rosmarinifolia*", suggests that Linnaeus' concept of *S. rosmarinifolia* was ambiguous. He shows a broad delimitation of *S. rosmarinifolia*, including specimens of other taxa of this genus (*S. canescens*, *S. chamaecyparissus*, and *S. virens*) into the circumscription of this species, and also excluding specimens that match it. There is a significant variation in Linnaeus' concept of *S. rosmarinifolia* with regard to the list of synonyms between *Hortus Cliffortianus* and *Species Plantarum*, but not in the diagnosis. The reverse occurs between the first edition of *Species Plantarum* (1753) and the editions of 1763 and 1764, as well as in *Systema Naturae* (Linnaeus 1759, 1767). Linnaeus did not follow a methodological rule in the selection of the synonyms. The same is true in the application of the diagnostic characters. The description of *S. rosmarinifolia* is brief and poor in diagnostic characters providing a clear distinction of this taxon. Botanists post-1753 developed a concept of *S. rosmarinifolia* analogous with that of Linnaeus, which lasted for approximately one century.

The results of the present work support the argument that *S. minor* (Miller 1768), *S. linearifolia* (Jordan & Fourreau 1869), *S. chamaecyparissus* L. subsp. *viridis* var. β *subintegrifolia* (Rouy 1903), *S. rosmarinifolia* L. f. *robusta* (Pau 1907), and *S. rosmarinifolia* L. var. *foliosa* (Sennen 1929) are synonyms of *S. rosmarinifolia*. The diagnosis of these names is short and poor in diagnostic characteristics, except for *S. linearifolia*, for which Jordan & Fourreau (1869) published a carefully elaborate diagnosis. Rouy (1903) used, for the first time, a quantitative character (diameter of the capitulum) in the diagnosis of a synonym of *S. rosmarinifolia*,

whereas Sennen & Elías, in Sennen (1929) added the curvature of the involucre bracts as a firm diagnostic character for *S. rosmarinifolia* L. var. *foliosa*.

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APPENDIX 1. — Specimen of *S. rosmarinifolia* L. (BM-CLIFF 000646963) preserved in the herbarium of Clifford.

