



## A new subspecies of *Rosmarinus officinalis* (Lamiaceae) from the eastern sector of the Iberian Peninsula

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### Abstract

*Rosmarinus officinalis* subsp. *valentinus* (Lamiaceae) is described as a new subspecies in the flora of the Iberian Peninsula. The diagnostic characters for the subsp. *valentinus* include several morphological differences, mainly based on a distinctly prostrate habit, a reduced leaf size, smaller calyx and corolla, and white flower. A comparative table with diagnostic morphological features to distinguish among the three subspecies of the *R. officinalis* is provided. Habitat, ecology, greenhouse cultivation and phenolic profile are also considered.

**Key words:** Lamiaceae, Mediterranean area, phenolic compounds, *Rosmarinus officinalis*, taxonomy

### Introduction

In the Iberian flora the genus *Rosmarinus* Linnaeus (1753: 23) is composed of three species and two hybrids (Rosúa 1981: 587; Morales 2010: 328): *R. officinalis* L., *R. eriocalix* Jord. & Fourr., *R. tomentosus* Hub.-Mor. & Maire, *R. × lavandulaceus* De Noé (*R. eriocalix* × *R. officinalis*) and *R. × mendizabalii* Sagredo ex Rosúa (*R. officinalis* × *R. tomentosus*).

*Rosmarinus* is frequently found in open formations and is one of the most common species in scrubland and the arboreal stratum. *Rosmarinus tomentosus* is endemic in the south of Spain (Granada and Malaga); *R. eriocalix* is distributed in North Africa (Morocco, Algeria and Libya) and Almeria (south of Spain) and *R. officinalis* is widespread and mainly distributed in the western half of the Mediterranean area, between Europe and North Africa, although it is almost absent in the eastern Mediterranean basin.

The high genetic variability of *R. officinalis* and its ecological plasticity, as well as its coexistence with the other two species of the genus in the southeast, suggest that its focus of diversification is located in this territory (Mateu-Andrés *et al.* 2013). The studies of Zaouali & Bousard (2008) reported a correlation between the allozyme genetic variability and the structure and composition of the essential oils. The biochemical variability is well characterized by chemotypes (Rosúa & García Granados 1987; Garbarino *et al.* 2006; Boelens 1985). Analyses of nuclear microsatellites have also been used to confirm certain genetic variability in the species (Segarra-Moragués & Gleiser 2009). However, other authors have described a relatively low genetic variability (Rosselló *et al.* 2006). Morphologically, *R. officinalis* consists of a broad range of varieties, forms, races and ecotypes (Turri 1920: 105).

A large amount of phenolic compounds has been found in several species of the Lamiaceae (Ziaková & Brandsteterová 2003; Barros *et al.* 2013; Kontogianni *et al.* 2013). The characterization of these compounds in this family has been studied in depth, with reports of differences among species in their phenolic profiles (Valant-Vetschera *et al.* 2003; Hossain *et al.* 2010).

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## References

- Amaral Franco J. & Rocha Alonso M.L. (1973) *Rosmarinus* L. In: T. G. Tutin *et al.* (eds.) *Flora Europaea* 3: 187. Cambridge University Press, Cambridge.
- Barros L., Dueñas M., Dias M.I., Sousa M.J., Santos-Buelga C., Ferreira I. (2013) Phenolic profiles of cultivated, in vitro cultured and commercial samples of *Melissa officinalis* L. infusions. *Food Chemistry* 132: 841–848.  
<http://dx.doi.org/10.1016/j.foodchem.2012.07.107>
- Boelens M.H. (1985) The essential oil from *Rosmarinus officinalis* L. *Perfumer & Flavorist* 10: 21–37.
- Bolòs, O. & Moliner R. (1958) Recherches phytosociologiques dans l'Île de Majorque. *Collect. Bot. (Barcelona)* 5(3): 699–865.
- Bolòs, O. & Vigo J. (1996) *Flora dels Països Catalans*. Vol. 3. Barcino. Barcelona.
- Bolòs O., Vigo J., Masalles R.M. & Ninot J. M. (2005) *Flora manual dels Països Catalans*. 3<sup>a</sup> ed. Pòrtic, Barcelona.
- Crespo, M.B. (2001) Ajustes nomenclaturales en matorrales iberolevantine de *Rosmarinetaea*. *Flora Montiberica* 18: 1–4.
- De la Torre, A., Alcaraz, F. & Crespo, M. B. (1996) Aproximación a la biogeografía del sector Setabense (provincia Catalano-Valenciano-Provenzal). *Lazaroa* 16: 141–158.
- Garbarino, J.A., Troncoso, N., Delpiano, P., Carvajal, L. & Russo, A. (2006) Antioxidant activity analysis for the selection of *Rosmarinus officinalis* L. *Natural Product Communications* 1:1123–1128.
- Greuter, W., H.M. Burdet & G. Long (1986) *Med-Checklist. 3. Dicotyledones (Convolvulaceae -Labiatae)*. Geneve & Berlin.
- Guara, M. (2002) *Elaboración de un Mapa de Densidades de Flora Singular de la Comunidad Valenciana*. Generalitat Valenciana-Universitat de València. Valencia.
- Hossain M. B., Rai D. K., Brunton N. P., Martin-Diana A. B. & Barry-Ryan C. (2010) Characterization of Phenolic Composition in Lamiaceae Spices by LC-ESI-MS/MS. *Journal of Agricultural and Food Chemistry* 50: 10576–10581.  
<http://dx.doi.org/10.1021/jf102042g>
- Kontogianni V.G., Tomic G., Nikolic I., Nerantzaki A.A., Sayyad N., Stosic-Grujicic S., Stojanovic I., Gerathanassis I. P. & Tzakos A. G. (2013) Phytochemical profile of *Rosmarinus officinalis* and *Salvia officinalis* extracts and correlation to their antioxidant and anti-proliferative activity. *Food Chemistry* 136: 120–129.  
<http://dx.doi.org/10.1016/j.foodchem.2012.07.091>
- Linares I.B., Arráez-Román D., Herrero M., Ibañez E., Segura-Carretero A. & Fernandez-Gutierrez A. (2011) Comparison of different extraction procedures for the comprehensive characterization of bioactive phenolic compounds in *Rosmarinus officinalis* by reversed-phase high-performance liquid chromatography with diode array detection coupled to electrospray time-of-flight mass spectrometry. *Journal of Chromatography A* 1218: 7682–7690.  
<http://dx.doi.org/10.1016/j.chroma.2011.07.021>
- Mateu-Andrés, I., Aguilera A., Boisset F., Currás R., Guara M., Laguna E., Marzo A., Puche M<sup>a</sup>. F. & Pedrola J. (2013) Geographical patterns of genetic variation in rosemary (*Rosmarinus officinalis*) in the Mediterranean basin. *Botanical Journal of the Linnean Society* 171: 700–712.  
<http://dx.doi.org/10.1111/boj.12017>
- Morales, R. (2010) *Rosmarinus* L. In: Morales R. *et al.* (eds.). *Flora iberica* 12: 327–331. Real Jardín Botánico, C.S.I.C., Madrid.
- Pau, C. (1891) *Notas botánicas a la flora española*. Fascículo 4<sup>o</sup>. Escuela Tipográfica del Hospicio. Madrid.
- Rivas-Martínez, S. (2007) Mapa de series, geoseries y geopermaseries de vegetación de España. Memoria del Mapa de Vegetación Potencial de España. Parte 1. *Itinera Geobotanica* 17: 1–436.
- Rivas-Martínez, S., Díaz, T. E., Fernández-González, F., Izco, J., Loidi, J., Lousã, M., & Penas, A. (2002) Vascular plant communities of Spain and Portugal. Addenda to the syntaxonomical checklist of 2001. Part. I. *Itinera Geobotanica*, 15: 5–922.
- Rosselló J. A., R. Cosín, M., Boscaiu, O., Vicente, I., Martínez & P. Soriano (2006) Intra-genomic diversity and phylogenetic systematics of wild rosemary (*Rosmarinus officinalis* L. s.l., Lamiaceae) assessed by nuclear ribosomal DNA sequences (ITS). *Plant Systematics and Evolution* 262: 1–12.  
<http://dx.doi.org/10.1007/s00606-006-0454-5>
- Rosselló, J. A. & Sáez L. (2000) Index Balearicum: An annotated check-list of the vascular plants described from the Balearic Islands. *Collectanea Botanica (Barcelona)* 25(1): 3–203.

- Rosúa, J.L. (1981) El complejo *Rosmarinus eriocalyx-tomentosus* en la Península Ibérica. *Anales del Jardín Botánico de Madrid* 37(2): 587–595.
- Rosúa, J.L. (1986) Contribución al estudio del género *Rosmarinus* L. en el Mediterráneo Occidental. *Lagascalia* 14(2): 179–187.
- Rosúa, J.L. & García Granados A. (1987) Analyse des huiles essentielles d'espèces du genre *Rosmarinus* L. et leur intérêt en tant que caractère taxonomique. *Plantes médicinales et phytothérapie* 21: 138–143.
- Segarra-Moragués J.G. & Gleiser G. (2009) Isolation and characterization of di and tri nucleotide microsatellite loci in *Rosmarinus officinalis* (Lamiaceae), using enriched genomic libraries. *Conservation Genetics* 10: 571–575.  
<http://dx.doi.org/10.1007/s10592-008-9572-7>
- Turril, W.B. (1920) The genus *Rosmarinus*. *Kew Bulletin* 105–107
- Valant-Vetschera K.M., Roitman J.N. & Wollenweber E. (2003) Chemodiversity of exudate flavonoids in some members of the Lamiaceae. *Biochemical Systematics and Ecology* 31: 1279–1289.  
[http://dx.doi.org/10.1016/S0305-1978\(03\)00037-1](http://dx.doi.org/10.1016/S0305-1978(03)00037-1)
- Zaouali, Y. & Boussard M. (2008) Isozyme markers and volatiles in Tunisian *Rosmarinus officinalis* L. (Lamiaceae): A comparative analysis of population structure. *Biochemical Systematics and Ecology* 36: 11–21.  
<http://dx.doi.org/10.1016/j.bse.2007.08.005>
- Ziaková A. & Brandsteterová E. (2003) Validation of HPLC determination of phenolic acids present in some Lamiaceae family plants. *Journal of Liquid Chromatography & Related Technologies* 26: 443–453.  
<http://dx.doi.org/10.1081/JLC-120017181>