Supplementary Material

Biodiversity and Conservation

Elaiosome-bearing plants from the Iberian Peninsula and the Balearic Island

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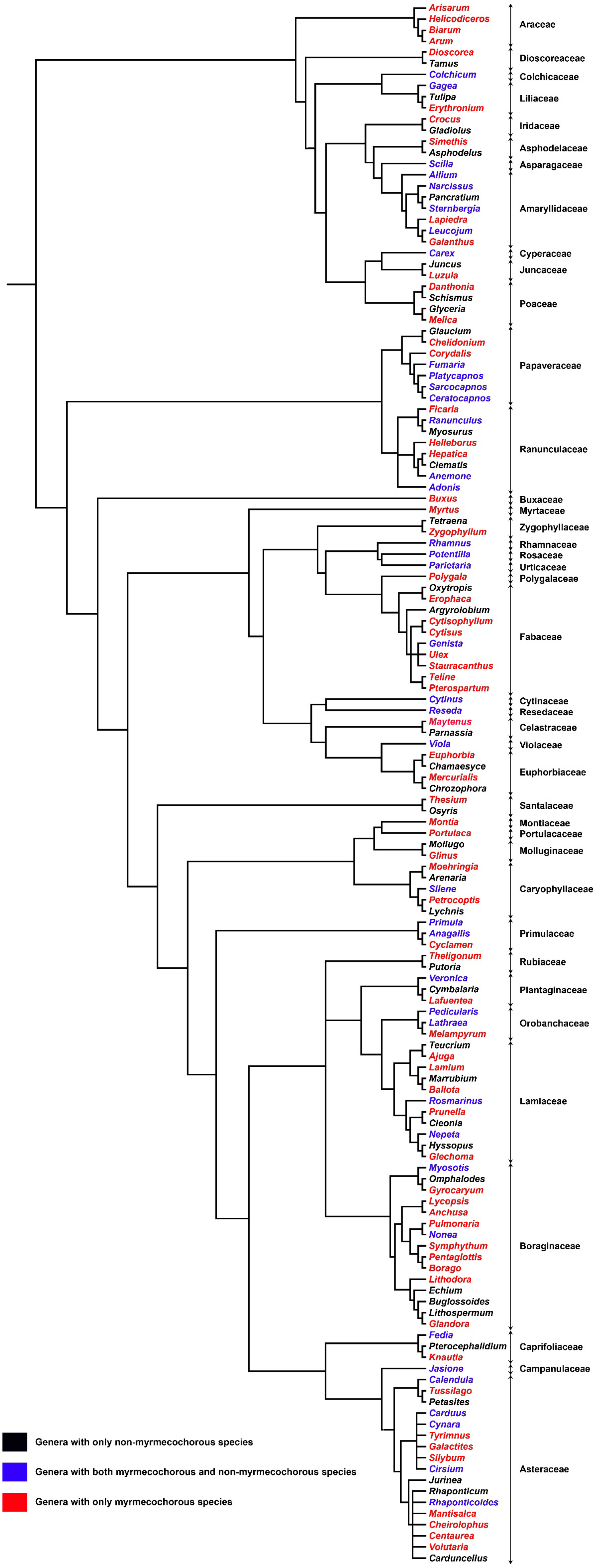
Appendix B Phylogenetic tree illustrating intergeneric relationships, generated in Mesquite, considering all the myrmecochorous and non-myrmecochorous taxa in the studied territory



Appendix C Additional analyses to correlate myrmecochory and characteristics of the taxa: methodology and results

Methodology To confirm the results of the statistical analyses described in the main text, we also considered the topology of a phylogenetic tree based on the selected taxa. A phylogenetic tree with all the 1,381 taxa included in the database was created in Mesquite 3.61 (Maddison and Maddison 2019) (see Appendix B**)**. Relationships among genera in the constructed tree were the same as those reconstructed previously for the Mantel test. In each genus, all species were represented as a polytomy in the tree. The same matrix used in the previous statistical analysis was imported into Mesquite 3.61, and Pagel (1994) test was carried out to analyze the correlation between the presence of elaiosomes (the *x* variable) and different characteristics (the *y* variable). The following parameters were used in the analysis: (1) *y* depends on *x*, (2) 10 extra iterations, and (3) 1,000 simulations to estimate *p*-values. Given that information was not available for all studied parameters and this type of analysis only works in Mesquite when no missing data are present, only the following parameters were analyzed: endemism, biogeography (Mediterranean, Eurosiberian, or both) and habit (annual, biannual, or perennial).

Results Pagel's test uncovered a significant correlation between myrmecochory and endemism, Eurosiberian distribution, annual habit, and perennial habit, but no correlation with Mediterranean distribution or biannual habit was found.

Given that not all characters in the matrix could be analyzed and taking into account manuscript length restrictions, the results of this analysis are not included or discussed in the main text.

References

Maddison WP, Maddison DR (2019) Mesquite: a modular system for evolutionary analysis. Version 3.61. http://www.mesquiteproject.org. Accessed 3 June 2020

Pagel M (1994) Detecting correlated evolution on phylogenies: a general method for the comparative analysis of discrete characters. Proc R Soc B 255:37–45

Appendix D Methodology used for comparative analysis of myrmecochory levels between different territories

To estimate the level of myrmecochory (percentage of myrmecochores among angiosperms) in the study area (Iberian Peninsula and the Balearic Islands) and allow comparisons with other areas of the world for which published information on the approximate number of myrmecochores is available, we counted the number of angiosperms. These numbers were obtained from floras of the territories involved in the analysis, when available (Austria, Australia and North America); in the case of the Iberian Peninsula and the Balearic Islands, temperate Europe and the Cape region, the information was extracted from studies on the flora or myrmecochore diversity (see below).

In some cases, only native taxa were represented for the number of angiosperms; in other cases, non-native ones were included as well (Table S1).

Iberian Peninsula and Balearic Islands: the total number of native taxa of vascular plants, calculated according to Buira et al. (2017), was 6,518. Gymnosperms and pteridophytes have been subtracted from this number as detailed in *Flora iberica* (Castroviejo et al. 1986).

Austria: in the first version of the *Checklist of the Austrian Flora*, Gilli et al. (2019) included 7,211 taxa. This catalog was exhaustively analyzed, and gymnosperms, pteridophytes, allochthonous taxa, and varieties and names provisionally accepted or questioned were eliminated.

Temperate Europe: Servigne (2008) expressly indicated the number of angiosperms for this territory.

Cape Province: the number of angiosperms for this territory was taken from Goldblatt and Manning (2002).

Australia: this information was extracted from volume 1 of the *Flora of Australia* (Orchard 1999).

North America: the number of plants included in this flora is 20,000 (Morin et al. 2015; see introductory chapter in *Flora of North America* - FNA: http://beta.floranorthamerica.org/Introduction). This value includes vascular plants and bryophytes. To obtain the number of angiosperms, bryophytes (see introductory chapter in FNA: http://beta.floranorthamerica.org/Introduction), ferns, and gymnosperms (Volume 2 of FNA) were subtracted from the total.

The estimated number of angiosperms and myrmecochorous taxa in the different analyzed territories is shown in Table S1.

Table S1 Total and myrmecochorous taxa in the analyzed territories

Territory	Total angiosperm[a]	Total myrmecochores[b]	References
Iberian Peninsula and Balearic Islands	6,378 (N)	572	[a] Buira et al. (2017); Castroviejo (1986) [b] Ortega-Olivencia et al., this work
Austria	3,140 (N)	89	[a] Gilli et al. (2019) [b] Krückl in Mayer (2009)
Temperate Europe	3,565 (N plus A)	106	[a, b] Servigne (2008)
Cape Province	8,920 (N)	1,300	[a] Goldblatt & Manning (2002) [b] Bond & Slingsby (1983)
Australia	18,095 (N plus n)	1,500	[a] Orchard (1999) [b] Berg (1975)
North America	17,846 (N plus n)	485	[a] FNA (1993 +); Morin et al. (2015) [b] Vander Wall et al. (2017)

N = natives taxa; n = naturalized taxa; A = established and frequent casual alien taxa

References

Berg RY (1975) Myrmecochorus plants in Australia and their dispersal by ants. Austral J Bot 23:475–508

Bond WJ, Slingsby P (1983) Seed dispersal by ants in shrublands of the Cape Province and its evolutionary implications. S Afr J Sci 79:231–233

Buira A, Aedo C, Medina L (2017) Spatial patterns of the Iberian and Balearic endemic vascular flora. Biodivers Conserv 26:479–508

Castroviejo S et al (eds) (1986) Flora iberica 1. Real Jardín Botánico, CSIC, Madrid

FNA (1993 +): Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 19+ vols. New York and Oxford. http://beta.floranorthamerica.org/Main_Page. Accessed 3 June 2020

Gilli C, Gutermann W, Billensteiner A, Niklfeld H (2019) Liste der Gefäßpflanzen Österreichs Version 1.0 in An Annotated Checklist of the Austrian Flora. Vienna University. https://plantbiogeography.univie.ac.at/research/annotated-checklists/. Accessed 3 June 2020

Goldblatt P, Manning C (2002) Plant diversity of the Cape region of Southern Africa. Ann Missouri Bot. Gard 89:281–302

Mayer V, Ölzant S, Fischer RC (2005) Myrmecochorous seed dispersal in temperate regions. In: Forget P-M, Lambert JE, Hulme PE, Vander Wall SB (eds) Seed fate: Predation, and dispersal and seedling establishment. CABI Publishing, Wallingford, pp 175–195

Morin NC, Brouillet L, Levin GA (2015) Flora of North America North of Mexico. Rodriguésia 66:973–98

Orchard AE (ed) (1999) Flora of Australia, Vol. 1. 2nd edn. Australian Biological Resources Study, Canberra

Servigne P (2008) Étude expérimentale et comparative de la myrmécochorie: le cas des fourmis dispersatrices *Lasius niger* et *Myrmica rubra*. Thèse de Doctorat. Communauté française de Belgique, Université Libre de Bruxelles

Vander Wall SB, Barga SC, Seaman AE (2017) The geographic distribution of seed-dispersal mutualisms in North America. Evol Ecol 31:725–740

Appendix E Percentage of myrmecochorous and non-myrmecochorous taxa in relation to different variables

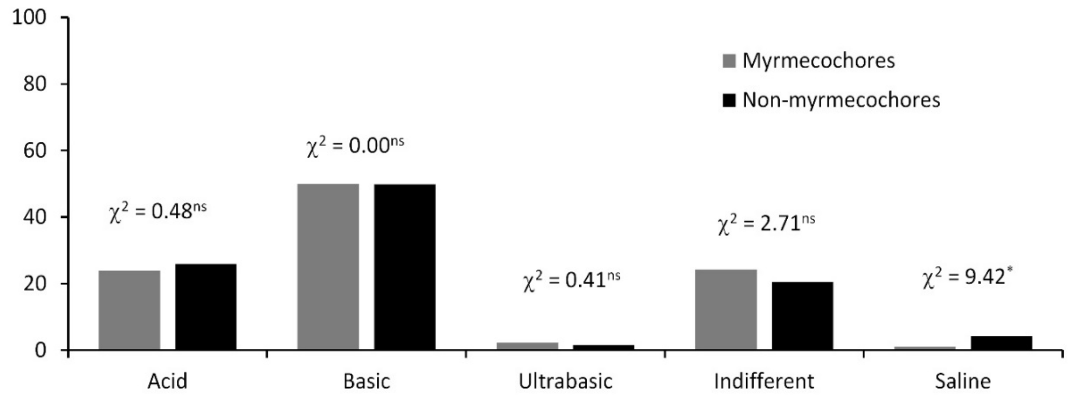


Fig. S1 Percentage of myrmecochorous and non-myrmecochorous taxa and the results of a Pearson chi-square test comparing different substrates, with P values adjusted using the false discovery rate. χ^2: *, $P < 0.05$; ns, not significant

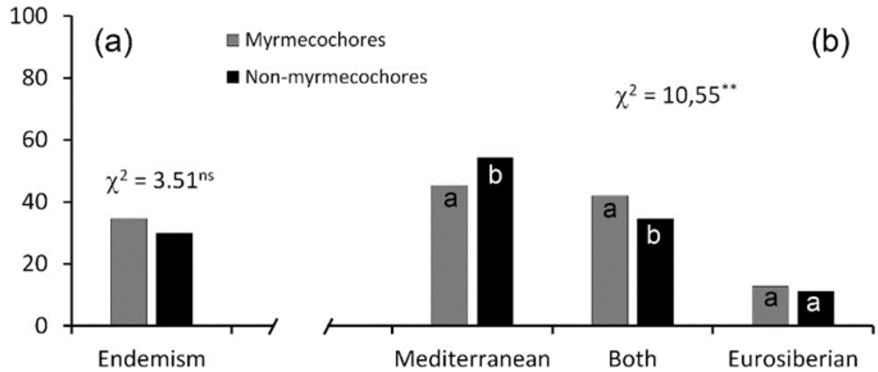


Fig. S2 Percentage of myrmecochorous and non-myrmecochorous taxa and the results of a Pearson chi-square test comparing the presence of endemism and different biogeographical regions. **a** Endemism. **b** Biogeographical regions. χ^2: **, $P < 0.01$; ns, not significant. Different letters at the same biogeographical region indicate significant differences between myrmecochores and non-myrmecochores

Appendix F Potentially myrmecochorous taxa from the Iberian Peninsula and the Balearic Islands

Eudicots
Asteraceae
Calendula suffruticosa Vahl
Carduus carlinifolius Lam. subsp. *carlinifolius*
Carduus carlinoides Gouan subsp. *carlinoides*
Carduus carlinoides subsp. *hispanicus* (Kazmi) Franco
Carduus carpetanus Boiss. & Reut.
Carduus crispus subsp. *multiflorus* (Gaudin) Franco
Carduus meonanthus Hoffmanns. & Link subsp. *meonanthus*
Carduus paui Devesa & Talavera
Carduus platypus subsp. *granatensis* (Willk.) Nyman
Centaurea bofilliana Sennen ex Devesa & E. López
Centaurea calcitrapa L.
Centaurea corcubionensis M. Laínz
Centaurea debeauxii subsp. *grandiflora* (Gaudin ex Schübl. & G. Martens) Devesa & Arnelas
Centaurea emporitana (Vayr. ex Sennen & Pau) Sennen
Centaurea exarata Boiss. ex Coss.
Centaurea gallaecica (M. Laínz) Arnelas & Devesa
Centaurea graminifolia (Lam.) Muñoz Rodr. & Devesa
Centaurea jacea subsp. *vinyalsii* (Sennen) O. Bolòs, Nuet & Panareda
Centaurea janeri Graells subsp. *janeri*
Centaurea kunkelii N. Garcia
Centaurea pectinata L.
Centaurea stuessyi Arnelas, Devesa & E. López
Cirsium glabrum DC.
Cirsium monspessulanum (L.) Hill
Cirsium odontolepis Boiss. ex DC.
Cynara cardunculus subsp. *flavescens* Wiklund
Cynara humilis L.
Boraginaceae
Lycopsis orientalis L.
Caryophyllaceae
Scleranthus perennis L.
Fabaceae
Cytisus decumbens (Durande) Spach
Cytisus dieckii (Lange) Fern. Prieto et al.
Lamiaceae
Ajuga pyramidalis subsp. *meonantha* (Hoffmanns. & Link) R. Fern.
Nepeta caerulea Aiton
Nepeta nepetella subsp. *aragonensis* (Lam.) Nyman
Nepeta nepetella subsp. *murcica* (Guirao ex Willk.) Aedo
Nepeta tuberosa L.
Prunella grandiflora (L.) Scholler
Prunella hyssopifolia L.
Prunella laciniata (L.) L.
Rosmarinus tomentosus Hub.-Mor. & Maire
Papaveraceae
Rupicapnos africana subsp. *decipiens* (Pugsley) Maire
Sarcocapnos baetica subsp. *ardalii* López Vélez
Sarcocapnos baetica subsp. *integrifolia* (Boiss.) Nyman
Sarcocapnos crassifolia subsp. *speciosa* (Boiss.) Rouy
Sarcocapnos pulcherrima C. Morales & Romero García
Sarcocapnos saetabensis G. Mateo Sanz & R. Figuerola Lamata

Plantaginaceae

Veronica fruticans Jacq.
Veronica praecox All.
Veronica spicata L.
Veronica triloba (Opiz) Opiz

Polygonaceae

Polygonum amphibium L.
Polygonum aviculare L.
Polygonum bellardii All.
Polygonum bistorta L.
Polygonum equisetiforme Sm.
Polygonum hydropiper L.
Polygonum lapathifolium L.
Polygonum maritimum L.
Polygonum minus Huds.
Polygonum mite Schrank
Polygonum persicaria L.
Polygonum rurivagum Jord. ex Boreau
Polygonum viviparum L.

Primulaceae

Primula acaulis subsp. *balearica* (Willk.) Greuter & Burdet ex Greuter

Rosaceae

Potentilla aurea L.
Potentilla inclinata Vill.

Violaceae

Viola lainzii P. Monts.

Monocots

Amaryllidaceae

Narcissus jonquilla L.
Narcissus nevadensis subsp. *herrerae* Algarra, Blanca, Cueto & J. Fuentes
Narcissus poeticus L.
Narcissus tazetta L.

Colchicaceae

Colchicum multiflorum Brot.

Tofieldiaceae

Tofieldia calyculata (L.) Wahlenb.

Underlined taxa = allochthonous