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Taxonomic composition and ecological characteristics of the endemic flora of the lower Duero Basin (Iberian Peninsula)

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Abstract. - The taxonomical composition and an analysis of four ecological characteristics of the 46 endemic species occurring in the lower Duero Basin (CW Iberian Peninsula) have been made. A comparative analysis of the results reveals that this endemic flora does not comply with the general patterns previously observed in other floras. Predominant life forms are hemicryptophytes (43%) and chamaephytes (22%). As far seed-dispersal is concerned, 54% of the endemic species lack any noteworthy adaptative feature. 89% of the endemic species are pollinated by animals (mostly by insects) and only 1 species is dioecious. Following binary classification of the above characteristics have been used to plot statistically significant associations.

Key words : biological spectrum - dioecy - endemic species - life forms - Portugal - pollination - seed dispersal strategy - Spain.

Résumé. - La composition taxonomique et une analyse de quatre caractéristiques écologiques des 46 espèces endémiques rencontrées dans le bassin inférieur du Duero (CW de la Péninsule Ibérique) ont été réalisées. Une analyse comparative des résultats montre que cette flore endémique ne correspond pas aux schémas généraux observés précédemment dans d'autres flores. Les formes biologiques prédominantes sont les hémicryptophytes (43%) et les chamaéphytes (22%). En ce qui concerne le mode de dispersion des diaspores, 54% des espèces endémiques sont dépourvues de tout aspect adaptatif particulier. 89% des espèces endémiques sont pollinisées par des animaux (essentiellement des insectes) et une seule espèce est dioïque. En se basant sur une classification binaire, les caractéristiques précédentes ont été utilisées pour représenter graphiquement les associations statistiquement significatives.

Mots clés : spectre biologique - espèces endémiques - formes biologiques - Portugal - pollinisation - stratégie de dispersion des diaspores - Espagne.

I. INTRODUCTION

In recent years, a number of studies have investigated the ecological characteristics of different local flora, including some from the Iberian Peninsula (*e.g.* Buide *et al.*, 1998; Giménez Luque & Gómez Mercado, 2003; Melendo *et al.*, 2003). Many of these studies have provided important data on the relationships between ecological characteristics and the geographical distribution of species (Gentry, 1988; Renner & Ricklefs, 1995), as well as information on the causes of Angiosperm diversification (Herrera, 1989; Midgley & Bond, 1991; Eriksson & Bremer, 1992; Tiffney & Mazer, 1995). Numerous studies have made detailed analyses of some of these features (*e.g.* Howe & Smallwood, 1982; Van der Pijl, 1982; Guitián & Sánchez, 1992; Pakeman, 2001; Van der Wall, 2001; Clark & Wilson, 2003) and their implications for conservation (Primack & Miao, 1992; Eriksson, 2000).

The analysis of the endemic flora of an area reveals its floristic uniqueness. This knowledge helps in phytogeographic studies, which are essential for understanding the origin, migration and speciation of taxa as well for developing adequate conservation strategies (Qian, 1999).

Information of the ecological characteristics of local floras is thus of interest for testing existing hypotheses and as a basis for the development of more general models. Here, we report a study of the taxonomical composition and ecological characteristics of the endemic flora of lower Duero Bassin, a region in the central western Iberian Peninsula. The aims were to (a) establish the taxonomic composition of this flora, (b) to collate information on the frequency of particular ecological characteristics among the endemic species of the region, (c) to identify possible associations between these characteristics and (d) to compare these characteristics and associations to those that present the flora of another territories in the Iberian Peninsula or in the Mediterranean Basin.

II. MATERIAL AND METHODS

A. Study area

The study area comprised a series of territories in the Lusitan Duriensean biogeographical sector (Carpetan Leonese subprovince, Mediterranean West Iberian province) (Rivas-Martínez *et al.*, 2002). These extended along the banks of the river Duero and some of its main affluents (the rivers Águeda, Huebra, Uces, Coa, Sabor), from the Spanish-Portuguese border to the mouth of the river Corgo near the Portuguese town of Régua (Fig. 1). The area's geographical and biogeographical location on the border between the Mediterranean and Eurosiberian worlds makes it floristically rich and complex with many endemic species and disjunctions. The area has a mediterranean macroclimate and mediterranean pluviseasonal oceanic bioclimate. It falls within the Mesomediterranean thermoclimatic belt, and has dry and subhumid ombrotypes (Rivas-Martínez *et al.*, 2002). Although the dominant rocks of the area are mainly acidophilous (mostly granites and quartzites), the presence of ultrabasic materials in some areas (*e.g.* in Morais and Izeda) encourages greater diversity of the flora and plant communities. The altitude of the area varies from 100 m on the banks of the Duero in the latter part of the studied course, to 700 m on the so-called "*planaltos*" or high plains.

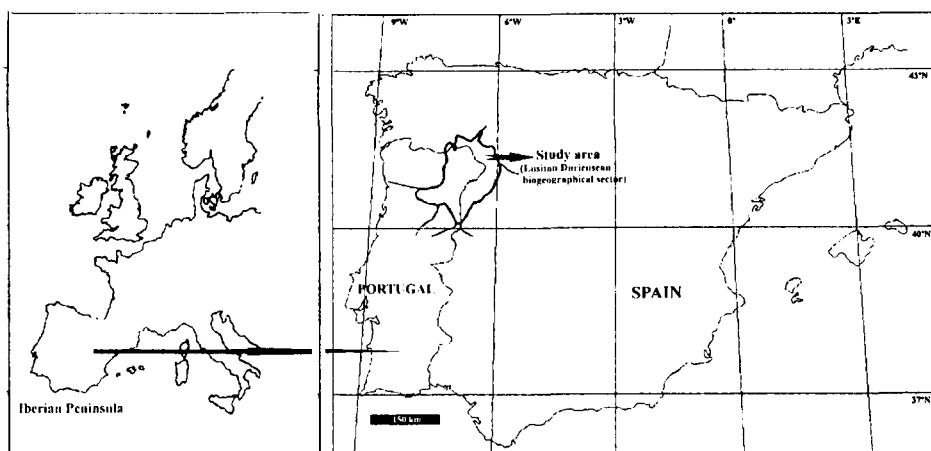


Fig. 1. – Area under study.

Fig. 1. – Région géographique étudiée.

B. Information sources

A list of endemic taxa of the lower Duero Basin was obtained from different floral studies (e.g. Amich, 1979; Sánchez Sánchez, 1979; Valle, 1982; Sánchez Rodríguez, 1986; Aguiar, 2001). This information was complemented with data from the volumes of *Flora Iberica* published to date (Castroviejo *et al.*, 1986–2003; Muñoz Garmendia & Navarro, 1998; Talavera *et al.*, 1999–2000; Paiva *et al.*, 2001) from *Nova Flora de Portugal* (Franco, 1971–1984; Franco & Rocha Afonso, 1994–1998) and from articles in scientific journals (e.g. Amich & Sánchez, 1983; Amich *et al.*, 1989; Bernardos & Tyteca, 2003; Bernardos *et al.*, 2003a, 2004a, 2004b, 2004c, 2004d; Marcos *et al.*, 2004). The information was completed by numerous collection expeditions to the area (vouchers deposited in the herbarium of the University of Salamanca, SALA). Forty six endemic or subendemic taxa were identified.

The data set included the following life forms according to Raunkiaer (1934), nanophanerophytes, chamaephytes, hemicryptophytes, geophytes and therophytes. Taxa were classified according to these life forms using the above-mentioned data and field observations. For statistical analysis, the life forms were gathered into two groups: woody plants (nanophanerophytes and chamaephytes) and herbaceous plants (hemicryptophytes, geophytes and therophytes).

Pollination methods (biotic or abiotic) were determined mainly from our own observations and according to Faegri & Van der Pijl (1979). Although the data obtained for some species allowed no specific plant-pollinator relationships (Herrera, 1996) to be discerned, this classification is valid for the aims of the present study.

The reproductive modes of the different species were determined after examining several flora (e.g. *Flora Iberica* and *Nova Flora de Portugal*) and from field observations. However, since the information available was often insufficient, taxa were classified as either hermaphrodites or dioecious.

Seed dispersal strategies were determined from the information reported in different studies (Van der Pijl, 1982; Murray, 1987) or inferred from the morphology of the fruit

(field and herbarium studies). Endozoochorous (EN), exozoochorous (EX), myrmecochorous (MY), anemochorous (small diaspores [As], with pappi [Ap] or winged [Aw]) and barochorous/semachorous (BS, no morphological adaptations for dispersal) strategies were identified. For statistical analysis, the dispersal mechanisms were gathered into two groups, biotic (endozoochores, exozoochores and myrmecochores) and abiotic (anemochores and barochores/semachores).

C. Data analysis

All analyses were carried out by means of simplified binary categories (herbaceous versus woody life form, biotic versus abiotic seed-dispersal, biotic versus abiotic pollination, hermaphroditism versus dioecy). The heterogeneity analysis of 2 x 2 contingency tables – by chi-square tests, or Fisher's exact test where one or more cells contained only a small number of cases – was the fundamental tool for finding out any statistically significant associations.

All analyses were made using the *Statistica* 6.0 package (StatSoft, 2001). Unless otherwise indicated, statistical significance is assumed by p-values lower than 5%.

III. RESULTS AND DISCUSSION

A. Taxonomic composition

Of the 46 taxa endemic to the study area (Appendix 1), 17 were exclusively Lusitan Duriensean. The remaining 29, though represented by large populations, are also found in other parts of the Iberia Peninsula. Though this number of endemic species is low compared to other regions of the Peninsula (Melendo *et al.*, 2003), it is actually quite large when the area's uniform lithology and geomorphology are taken into account.

With five taxa each, the best-represented families were the Fabaceae, Poaceae and Scrophulariaceae, followed by the Caryophyllaceae, Liliaceae and Plumbaginaceae (four taxa), and Brassicaceae and Ranunculaceae (three taxa). The eleven remaining families were represented by just one or two species. These results generally agree with those obtained in other local flora studies undertaken at similar latitudes in the Iberian Peninsula (Buide *et al.*, 1998; Melendo *et al.*, 2003), although the present area was richer (in terms of the percentage of representative species) in Scrophulariaceae and Liliaceae, and had fewer species of Asteraceae and Lamiaceae. The diagram in Fig. 2A shows the percentage distribution of these families.

The occurrence of vicariant species in isolated geographical habitats or sites indicates evolutive processes in connection with reproductive isolation (Sainz Ollero & Moreno

Fig. 2.- Spectres de la flore endémique du bassin inférieur du Duero. A - Spectre systématique (Fa = Fabaceae, Po = Poaceae, Sc = Scrophulariaceae, Ca = Caryophyllaceae, Li = Liliaceae, Pl = Plumbaginaceae, Br = Brassicaceae, Ra = Ranunculaceae, FF = familles avec moins de trois espèces) ; B - Spectre biologique selon les différentes formes biologiques de Raunkiaer (Na = nanophanérophytes, Ch = chaméphytes, He = hémicryptophytes, Ge = géophytes, Th = thérophytes); C - Spectre de pollinisation biotique (B) et abiotique (A) ; D - Spectre de dispersion des diaspores (EN = endozoochorie, EX = exozoochorie, My = myrmecochorie) et des mécanismes abiotiques de dispersion des graines (Ap = anémochorie liée aux pappus, As = anémochorie due à la petite taille, Aw = anémochorie liée aux ailes, BS = barochorie/sémachorie).

Saiz, 2002). The species of the families Orchidaceae, Plumbaginaceae and Scrophulariaceae are an example of these processes of speciation. Processes of fast speciation in the genus *Armeria* are encouraged by hybridization, polyploidy and apomixis (Nieto Feliner, 1997; Nieto Feliner *et al.*, 1996, 2001). Similar speciation patterns may have taken place in the genus *Epipactis* (Bernardos *et al.*, 2003b, 2004d).

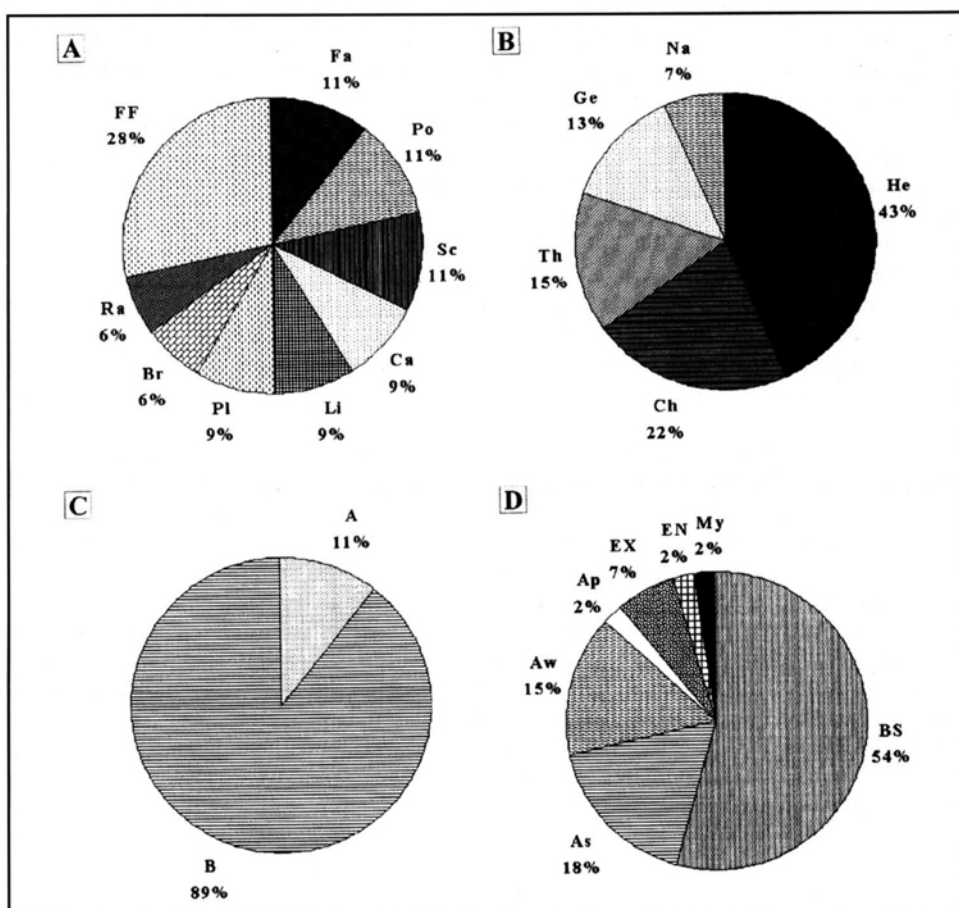


Fig. 2.- Spectra of the lower Duero Basin endemic flora. A - Percentage of species within each of the major families (Fa = Fabaceae, Po = Poaceae, Sc = Scrophulariaceae, Ca = Caryophyllaceae, Li = Liliaceae, Pl = Plumbaginaceae, Br = Brassicaceae, Ra = Ranunculaceae, FF = families with less than 3 species); B - Percentages of species with different Raunkiaer life forms (Na = nanophanerophytes, Ch = chamaephytes, He = hemi-cryptophytes, Ge = geophytes, Th = therophytes); C - Percentages of species with biotic (B) and abiotic (A) pollination strategy; D - Percentages of species with biotic seed-dispersal mechanisms (EN = endozoocory, EX = exozoocory, My = myrmecochory) and abiotic seed-dispersal mechanisms (Ap = anemochory due to pappi, As = anemochory due to small size, Aw = anemochory due to wings, BS = barochory/semachory).

B. Characteristics of the flora

Life form. Most of the endemic species were hemicryptophytes (Fig. 2B). The high proportion of annuals and perennials (71%) compared to woody species (29%) is characteristic of temperate regions (Crawley, 1986; Preston & Hill, 1997). Quézel (1995) indicates that therophytes and chamaephytes are the most common floral life forms of the Mediterranean Basin, while Braun-Blanquet (1964) reports that in some areas therophytes can make up half the flora. In the present study, however, therophytes were relatively scarce (15%; Fig. 2B). This percentage is rather similar to that obtained in studies of typically Mediterranean flora (Melendo *et al.*, 2003) and clearly lower than that indicated for temperate flora (Buide *et al.*, 1998). With respect to chamaephytes (22%, Fig. 2B), the present results are intermediate between those obtained in the south (Melendo *et al.*, 2003) and north (Buide *et al.*, 1998) of the Iberian Peninsula.

Pollination. A high percentage of the endemic taxa studied (89%) were biotically pollinated, mostly by insects (Fig. 2C). Some were pollinated by very few insects. Such is the case of the stenoendemic species *Antirrhinum lopesianum*, which is preferentially pollinated by the hymenopterans *Bombus hortorum* (L. 1761) and *B. terrestris* (L. 1758). The percentage of biotically-pollinated plants recorded here is higher than that observed in neighbouring areas at the same latitude (Gutián & Sánchez, 1992; Buide *et al.*, 1998), and similar to that indicated for other flora with few members of the family Poaceae (Melendo *et al.*, 2003). Typically, biotic pollination tends to be dominant in low and mid latitudes (Ricklefs & Renner, 1994).

Dispersal. Fig. 2D shows the percentage of species in the seven seed-dispersal categories. Only about 11% of species used biotic methods, and only 7% dispersed their seeds by exozoochory. This is in agreement with that indicated by Sorensen (1986) and Willson *et al.* (1990) for mid-latitude flora, and similar to that obtained for Galician (NW Spain) flora by Buide *et al.* (1998). Only 2% of the endemic plants use endozoochorous dispersion, a rate lower than the one recorded in floras of neighbouring areas (Kay, 1992; Buide *et al.*, 1998), but greater than that reported by Melendo *et al.* (2003) for the south of the Iberian Peninsula. Barochores/semachores were the most common with 25 species (54%). This figure is intermediate between that indicated by Melendo *et al.* (2003) and Buide *et al.* (1998). This result would appear to indicate that isolation, as a result of dispersion, is the most important factor explaining the presence of stenoendemic species such as *Antirrhinum lopesianum*, *Linaria coutinhoi*, *Scrophularia valdesii*, *Silene boryi* subsp. *duriensis* or *Trigonella polyceratia* subsp. *amandiana*.

35% of the endemic species showed adaptations to anemochorous dispersion. This is much higher than that recorded for the flora of temperate regions (Willson *et al.*, 1990; Buide *et al.*, 1998) and similar to that reported by Melendo *et al.* (2003) for the south of the Iberian Peninsula. However, the role of anemochory in many endemic flora cannot be of much importance since many of the adaptations seen appear not to be very efficient. For example, *Erysimum linifolium* has seeds with only rudimentary wings. The different endemic species of *Armeria* are similar in this respect. Costa Tenorio *et al.* (1985) indicate that even for the clearly winged diaspores (e.g. *Isatis platyloba*), anemochory seems to be of little importance (although Navarro Andrés *et al.* [1983] disagree). The present authors reached the same conclusion during demographic studies of *Isatis platyloba* (González Talaván *et al.*, 2003).

Reproductive mode. Since reproductive mode is strongly related to the taxonomic composition of a flora (Renner & Ricklefs, 1995), the proportion of dioecious species varies greatly from one to another (Bawa, 1980; Kay & Stevens, 1986). In the present study, dioecious flora made up 2.2% of all the dioecious plants. This is similar to the figure indicated by Buide *et al.* (1998) for the flora of Galicia and greater than that reported for other areas such as the south of the Iberian Peninsula (0.5%) (Melendo *et al.*, 2003) or Israel (1.7%) (Rottenberg, 1998).

C. Associations between characters

The heterogeneity analysis of contingency tables reveals some associations between the different variables under consideration (Table I).

Although the different life forms (herbaceous or woody) were significantly associated with seed-dispersal mode (Buide *et al.*, 1998), the present results show this relationship not to be as strong for the flora of the study area as for those of other territories (Table I). This is because the predominant life forms were hemicryptophytes and chamaephytes. The hemicryptophytes tend to have less specialised dispersal mechanisms than the woody species and barochory/semachory is clearly dominant (Fig. 3). Although endozoochory is reported to be dominant among the Angiosperms (Fleming, 1991) and the woodland and thomscrub communities of the Iberian Peninsula (Gutián & Sánchez, 1992), it does not appear to be important to endemic woody life forms since it implies long distance dispersal. Some authors indicate significant relationships between pollination mode and life form (Ricklefs & Renner, 1994), but none were detected in the present study, possibly because it compares species while Ricklefs & Renner compared families. Buide *et al.* (1998) found no such relationships either. Neither was any significant association seen between pollination mode and seed-dispersal strategy (Table I).

Table I.- Results of heterogeneity analysis of contingency tables cross-classifying the various ecological characters considered in this study. The binary classification used were herbaceous (H) or woody (W) for life form, abiotic (A) or biotic (B) for seed-dispersal mode and for pollination mode, and dioecious (D) or within-plant monoecious (M) for reproductive mode. Heterogeneity analysis were made by the chi-square test or Fisher's exact test.

Tableau I.- Résultats de l'analyse d'hétérogénéité des tables de contingence obtenues en croisant les différents caractères écologiques considérés dans cette étude. La classification binaire utilisée est herbacé (H) ou ligneux (W) pour la forme biologique, abiotique (A) ou biotique (B) pour le mode de dispersion des graines et le mode de pollinisation, et dioïque (D) ou monoïque par individu (M) pour le mode de reproduction. L'analyse d'hétérogénéité a été effectuée par le test de chi-carré ou le test exact de Fisher.

| Dispersal mode | | | Pollination mode | | | Reproduction mode | | |
|----------------------------------|----|----|----------------------------------|----|----|----------------------------------|----|---|
| Life form | A | B | Life form | A | B | Life form | M | D |
| H | 30 | 1 | H | 5 | 28 | H | 34 | 0 |
| W | 11 | 4 | W | 0 | 13 | W | 11 | 1 |
| $\chi^2 = 5.73 \quad P = 0.0167$ | | | $\chi^2 = 2.21 \quad P = 0.1371$ | | | $\chi^2 = 2.9 \quad P = 0.0888$ | | |
| Pollination mode | | | Reproduction mode | | | Reproduction mode | | |
| Dispersal mode | A | B | Dispersal mode | M | D | Pollination mode | M | D |
| A | 5 | 36 | A | 40 | 1 | A | 5 | 0 |
| B | 0 | 5 | B | 5 | 0 | B | 40 | 1 |
| $\chi^2 = 0.68 \quad P = 0.4082$ | | | $\chi^2 = 0.12 \quad P = 0.7240$ | | | $\chi^2 = 0.12 \quad P = 0.7240$ | | |

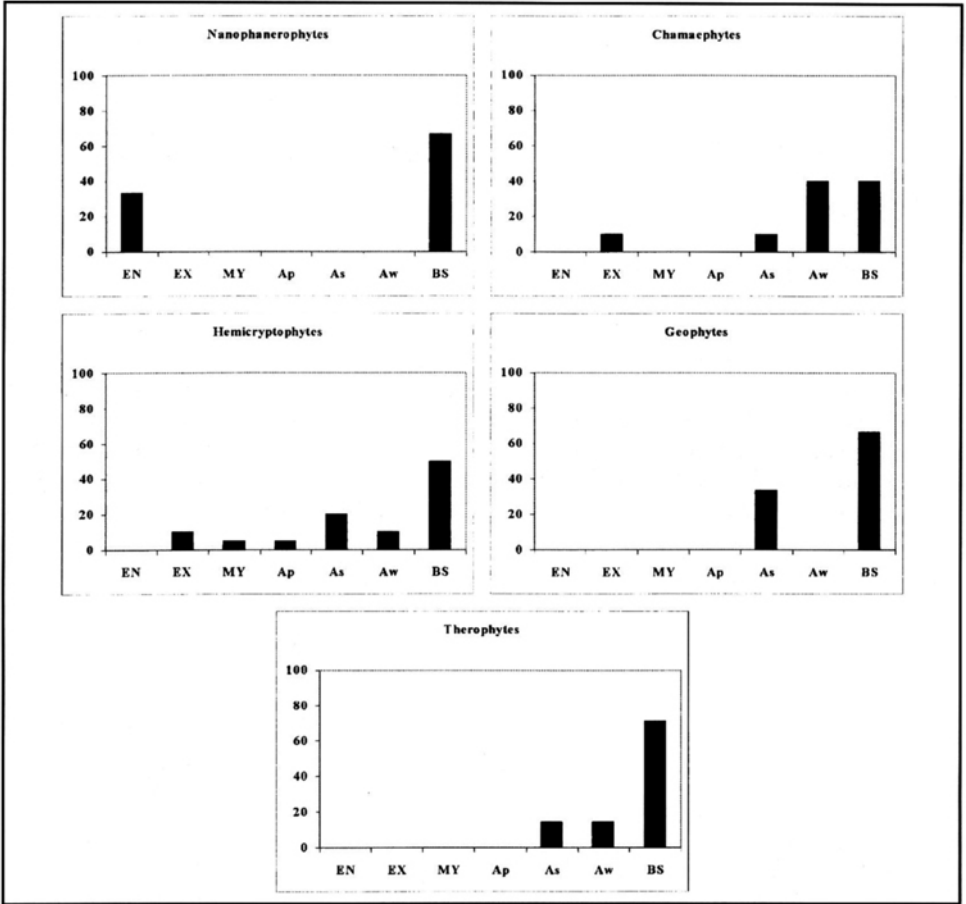


Fig. 3.- Frequency distribution of seed-dispersal mode within each life-form category for endemic species in the lower Duero Basin (EN = endozoochory, EX = exozoochory, MY = myrmecochory, Ap = anemochory due to pappi, As = anemochory due to small size, Aw = anemochory due to wings, BS = barochory/semachory).

Fig. 3.- Distribution de fréquence des modes de dispersion des diaspores dans chacune des catégories de formes biologiques pour les espèces endémiques du bassin inférieur du Duero (EN = endozoochorie, EX = exozoochorie, MY = myrmecochorie, Ap = anémochorie liée aux pappus, As = anémochorie due à la petite taille, Aw = anémochorie liée aux ailes, BS = barochorie/sémachorie).

Dioecy has also been related to a number of different characteristics such as woody character, zoochory, fleshy fruits or wind pollination (Muenchow, 1978; Bawa, 1980; Fox, 1985; Renner & Ricklefs, 1995). In contrast, for this endemic flora our data only reveal a weakly association between dioecy and woody character. We must not overlook, however, that dioecy is a rare feature among the species considered, since only one of them are dioecious. Such a small number makes any general conclusion on this issue overadventurous.

IV. CONCLUSIONS

The remarkable importance of families such as Liliaceae, Plumbaginaceae and Scrophulariaceae confers a particular taxonomic spectrum on the endemic flora of the lower Duero Basin, making it different to that of the rest of the Mediterranean flora.

In contrast to the usual spectrum of life forms for the Mediterranean region, in which terophytes are dominant, most of the endemic taxa of this central western part of the Iberian Peninsula are herbaceous (hemicyptophytes) or perennial woody species (chamaephytes).

A large number of endemic species (54 %) show no evident adaptations for promoting seed dispersal.

Dioecious species and nanophanerophytes, because of their relation to endozoochorous dispersion, are rare in the endemic flora under study.

A number of between-character associations were detected, but no association was found between pollination mode and life form, nor between pollination mode and dispersal strategy. Although between-character associations within the present endemic flora were significant, the majority differed from those observed in neighbouring flora. This confirms the uniqueness of the endemic flora of the lower Duero Basin.

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APPENDIX 1

Endemic taxa in the lower Duero Basin analysed in this study. Stenochory, biotype, dispersal, pollination and reproductive modes are shown for each of them.

Stenochory degree: Dst, endemic in the lower Duero Basin *sensu stricto*; Dsl, endemic in the lower Duero Basin *sensu lato*.

Life forms: Na, nanophanerophyte; Ch, chamaephyte; He, hemicryptophyte; Ge, geophyte; Th, therophyte.

Seed-dispersal mode: EN, endozoochory; EX, exozoochory; MY, myrmecochory; As, anemochory (small size); Ap, anemochory (pappi); Aw, anemochory (wings); BS, barochory/semachory.

Pollination mode: B, biotic; A, abiotic.

Reproductive mode: H, hermaphrodite; M, monoecious; D, dioecious.

1. *Allium schmitzii* Cout.

Dsl-Ge-BS-B-H

2. *Anarrhinum durimimum* (Brot.) Pers.

Dsl-He-BS-B-H

3. *Anthoxanthum amarum* Brot.

Dsl-He-As-A-H

4. *Anthyllis sampaioana* Rothm.

Dst-He-BS-B-H

5. *Anthyllis vulneraria* L. subsp. *lusitanica*

(Cullen & P. Silva) Franco

Dst-Th-BS-B-H

6. *Antirrhinum lopesianum* Rothm.

Dst-Ch-BS-B-H

7. *Arabis juresii* Rothm.

Dsl-He-BS-B-H

8. *Arenaria querioides* Pourr. ex Willk. subsp.

fontiqueri (P. Silva) Rocha Afonso

Dst-Ch-BS-B-H

9. *Armeria eriophylla* Willk.

Dst-Ch-Aw-B-H

10. *Armeria langei* Boiss. subsp. *langei*

Dsl-Ch-Aw-B-H

11. *Armeria langei* Boiss. subsp. *daveaui* (Cout.)

P. Silva

Dsl-Ch-Aw-B-H

12. *Armeria transmontana* (Samp.) Lawrence

Dsl-Ch-Aw-B-H

13. *Avenula pratensis* (L.) Dumort. subsp. *lusitanica* Romero Zarco

Dst-He-As-A-H

14. *Colchicum lusitanum* Brot.

Dst-Ge-BS-B-H

15. *Delphinium fissum* Waldst. & Kit. subsp.

sordidum (Cuatrec.) Amich, E. Rico & J.

Sánchez

Dsl-He-BS-B-H

16. *Dianthus laricifolius* Boiss. & Reuter subsp. *marizii* (Samp.) Franco
Dst-He-BS-B-H
17. *Digitalis thapsi* L. var. *amandiana* (Samp.) Cout.
Dst-He-BS-B-H
18. *Echinopartum ibericum* Rivas Mart., Sánchez-Mata & Sancho
Dsl-Na-BS-B-H
19. *Epipactis duriensis* Bernardos, Tyteca, Revuelta & Amich
Dst-Ge-As-B-H
20. *Epipactis lusitanica* Tyteca
Dsl-Ge-B-B-H
21. *Erysimum linifolium* (Pourr. ex Pers.) J. Gay
Dsl-He-Aw-B-H
22. *Euphorbia oxyphylla* Boiss.
Dsl-He-My-B-H
23. *Festuca duriotagana* Franco & Rocha Afonso
Dsl-He-As-A-H
24. *Festuca brigantina* (Markgr.-Danneb.) Markgr.-Danneb.
Dst-He-As-A-H
25. *Galium glaucum* L. subsp. *australe* Franco
Dsl-Ch-EX-B-H
26. *Genista hystrix* Lange
Dsl-Na-BS-B-H
27. *Helianthemum apenninum* (L.) Mill. subsp. *rothmaleri* (Huguet del Villar ex Rothm.) Mayor & Fern. Benito
Dsl-Ch-BS-B-H
28. *Holcus annuus* Salzm. subsp. *duriensis* (P. Silva) Franco & Rocha Afonso
Dst-Th-As-A-H
29. *Isatis platyloba* Link ex Steud.
Dsl-Th-Aw-B-H
30. *Laserpitium eliasii* Sennen & Pau subsp. *thalictrifolium* (Samp.) P. Monts.
Dsl-He-Aw-B-H
31. *Leuzea raphonticoides* Graells
Dsl-He-Ap-B-H
32. *Linaria coutinhoi* B. Valdés
Dst-Th-BS-B-H
33. *Paradisea lusitanica* (Cout.) Samp.
Dsl-Ge-BS-B-H
34. *Ranunculus bupleroides* Brot.
Dsl-He-EX-B-H
35. *Ranunculus henriquesii* Freyn
Dsl-He-EX-B-H
36. *Rubus sampaioanus* Sudre ex Samp.
Dsl-Na-EN-B-H
37. *Scilla ramburei* Boiss. subsp. *beirana* (Samp.) Franco & Rocha Afonso
Dsl-Ge-BS-B-H
38. *Scrophularia valdesii* Ortega-Olivencia & Devesa
Dst-He-BS-B-H
39. *Sedum pedicellatum* Boiss. & Reuter subsp. *lusitanicum* (Willk. ex Mariz) M. Láziz
Dsl-Th-BS-B-H
40. *Seseli montanum* L. subsp. *peixoteanum* (Samp.) M. Láziz
Dsl-He-BS-B-H
41. *Sideritis hirsuta* L. subsp. *daniellii* (Rivera & Obón) Bernardos, Aguiar & Amich
Dsl-Ch-As-B-H
42. *Silene marizii* Samp.
Dsl-He-BS-B-H
43. *Silene boryi* Boiss. subsp. *duriensis* (Samp.) Cout.
Dst-He-BS-B-H
44. *Thymelaea broteriana* Cout.
Dsl-Ch-BS-B-D
45. *Trigonella polyceratia* L. subsp. *amandiana* (Samp.) Amich & J. Sánchez
Dst-Th-BS-B-H
46. *Valerianella lusitanica* Font Quer
Dst-Th-BS-B-H