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The historical biogeography and conservation value of taxonomic distinctness: The case of ferns flora of the Gibraltar Arc

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Abstract. The pteridofloras of nine locations in the Gibraltar Arc were analyzed using a taxonomic distinctness index. We found that the index could be a proxy of historical biogeography of the pteridofloras from this area. Moreover, the value of the taxonomic distinctness index of the different locations showed relevant relationships with certain geographic variables. Finally, we hypothesize about the value of the information derived from taxonomic distinctness index for conservation of the pteridoflora in the Gibraltar Arc.
Keywords: Pteridophytes, Western Mediterranean, Historical biogeography, Conservation

[es] Biogeografía histórica y valor conservacionista de la diferenciación taxonómica: ejemplo de la pteriflora de Arco de Gibraltar

Resumen. La pteridoflora de nueve localidades singulares situadas en el Arco de Gibraltar ha sido analizada utilizando un índice de distinción taxonómica. Encontramos que el índice podría ser una aproximación a la historia biogeográfica de las pteridofloras de esta zona. Además, el valor del índice de distinción taxonómica de las diferentes localidades mostró relaciones relevantes con determinadas variables geográficas. Finalmente, discutimos el posible papel de la información derivada del índice de distinción taxonómica en la conservación de la pteridoflora del Arco de Gibraltar.
Palabras clave: Pteridofitas, Mediterráneo Occidental, Biogeografía histórica, Conservación

Introduction

The fern flora of the Gibraltar Arc, i.e., the geological region corresponding to an arcuate orogen surrounding the Alboran Sea, extending from the Iberian Peninsula to Africa, has been extensively studied recently by Salvo Tierra et al. (2020). These authors suggested that the factors influencing diversity in fern floras of nine different mountain areas is so relevant that they should be included in the management of the territory. They concluded that the altitudinal gradient and the amplitude of the dry period have determined the distribution of pteridophytes in the Gibraltar Arc, a distribution in which the longitudinal gradient predominates over the latitudinal gradient. In particular, the oldest fern floras (with greater diversity) are located at the western ends of the arc on both continents. Five pterido-geographic units were detected, two of them spanning S Europe and N Africa, and eleven chorotypes. Finally, considering the diversity, age, singularity, and degree of threat to its pteridoflora, it was proposed that the Gibraltar Arc could be considered as a 'Sanctuary for ferns', an increasingly widespread conservation concept.

Taxonomic structure (based on the number of taxa included in higher levels of the taxonomic hierarchy) has been widely used in ecology to measure impacts on the diversity of ecosystems (for example, Clarke & Warwick 1998, 1999, 2001, Tucker et al. 2017, Pérez Hernández 2019). Taxonomic structure shows a latitudinal gradient and is maximum at the Equator (Krug et al. 2008). Among taxonomic richness estimators, taxonomic distinctness (TD; Pérez Hernández 2019, and references therein) is particularly significant because it appears to be less influenced by sample size than are species richness or Shannon species diversity. Moreover, TD may be a more sensitive univariate index of community perturbation than spe-

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cies diversity (Pérez Hernández 2019, and references therein). Furthermore, the statistical significance of the TD index can be tested (Clarke & Warwick 2001, Pérez Hernández 2019). Clarke & Warwick (1998) proposed the Δ+ index (i.e., Delta-plus) to estimate taxonomic distinctness. This index measures the overall mean taxonomic path length between any two randomly chosen taxa. Because the index has no dependence on sampling effort, the Δ+ figures computed from different sources of data can be compared across studies with differing and uncontrolled degrees of sampling effort.

The main aim of the current note is to analyze the TD of fern floras from the Gibraltar Arc. The goal is to assess the differences in biogeographical composition on opposite shores of the Alboran Sea.

Material and Methods

Data origin

The determination of the OGUs (operative geographical units) was carried out according to criteria of geophysical homogeneity and in correspondence with the biogeographic units, according to Salvo Tierra et al. (2020). Nine mountain areas located in the Gibraltar Arc were selected, one for each biogeographical sector; the areas include the entire range of thermo- and ombrotypes found in these regions (Rivas Martinez 2008): Gata, Nevada, Tejeda, Ronda, Aljibe, Tingitania, Chaouen, Gurugú and Tlemcen (Fig. 1). The basic matrix of data is showed in the supplementary data (metadata available in Salvo Tierra et al., 2020).

Data Analysis

The Δ+ index is computed according to the equation:

$$\Delta + = \left[\Sigma \sum_{i<j} w_{ij} \right] \Big/ [s(s-1)/2]$$

where s is the number of species observed, and w_{ij} is the weight or distinctiveness value given to each taxonomic branch of the hierarchical classification, from species i to the first node in common with species j. Thus, $w_{ij} = 0$ if i and j are the same genus, $w_{ij} = 1$ if they are the same family.

We calculated the Δ+ index for each region (i.e., Tingitania, Chauen, Gurugú, Tlemcen, Aljibe, Ronda, Tejeda, Nevada, and Gata) using the free PAST software (Hammer et al. 2001). Confidence intervals were calculated from 1000 random replicates taken from the pooled data set (Hammer 2020).

In addition, in a second step, linkage cluster analysis of the Δ+ index per locality was performed using a multivariate agglomerative method. Thus, we used the Bray-Curtis distance to generate the similarity matrix, using the free PAST version 4.02 software (Hammer et al. 2001). We chose Bray-Curtis distance to generate the similarity matrix, because it is especially recommended for standardized data (Yoshioka 2008) (Fig. 2).

For each OGU, the values of latitude, longitude, maximum altitude, TD and TD range values (the difference between the upper and lower limits), specific richness, index m/t (Ito 1972, 1978) and degree of ploidy, as well as the percentages of the presence of each of the generalized tracks detected in the study area, were included in the analysis (Salvo Tierra et al. 2020).

Results and Discussion

The Δ+ index for each region (i.e., Tingitania, Chauen, Gurugú, Tlemcen, Aljibe, Ronda, Tejeda, Nevada, and Gata) was estimated. We did not observe significant differences according to the criteria of the index. However, we observed three different and coherent similar groups according their Δ+ values (Fig. 1). Because the significance of the index was developed under other criteria (in relation to the number of sampling stations, and the number of species) (Clarke & Warwick 1998, 1999, 2001), we consider that they may not be useful here.

From Table 1 we conclude: 1) There is a strong inverse correlation between the value of TD and the maximum altitude (the lower the altitude, the greater the distinctness), as well as with the geographical longitude (decreasing from west to east) and with the index m/t. 2) From this last analysis, it can be inferred that there is a correspondence between higher values of TD and the older pteridofloras (the proportion of taxa with trilete spores = primitive character, is high compared to those with monolete spores = advanced character). 3) This same observation is corroborated on the one hand by analysing the correspondence between TD and the degree of ploidy (the lowest values of the degree of ploidy correspond to the most primitive pteridofloras), and on the other by observing that the lowest values of TD are correlated with those pteridofloras in which the generalized tracks of wider distributions (heterochoric and circumboreal) have a greater weight. 4) Consequently, the highest values of TD correspond to the most relict pteridofloras, although they arose from different historical events, and are scarcely ‘contaminated’ by species with wider geographical ranges that were incorporated into the territory during subsequent events. 5) Finally, TD has a complementary significance in the definition of priority conservation areas. In this sense, the lower values in the range of the upper and lower limits of TD for Aljibe and Nevada indicate a more ancestral and consolidated flora, which would support a high priority as regions for the conservation of pteridophytes. This is confirmed when applying the Vane-Wright et al. (1993) these two units are defined in the first cycle on the application method.

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References

Clarke, K. R. & Warwick, R.M. (1998). A taxonomic distinctness index and its statistical properties. *Journal of Applied Ecology* 35 (4), 523-531. https://doi.org/10.1046/j.1365-2664.1998.3540523.x

Clarke, K. R. & Warwick, R.M. (1999). The taxonomic distinctness measure of biodiversity: weighting of step lengths between hierarchical levels. *Marine Ecology Progress Series* 184, 21-29. https://www.jstor.org/stable/24853226

Clarke, K. R. & Warwick, R.M. (2001). A further biodiversity index applicable to species lists: variation in taxonomic distinctness. *Marine Ecology Progress Series* 216, 265-278. doi:10.3354/meps216265

Given, D.R. (1993). Changing Aspects of Endemism and Endangerment in Pteridophyta. *Journal of Biogeography,* 20 (3), 293-302. https://www.jstor.org/stable/2845638

Hammer, Ø. (2020). *PAST manual version 4.02*. Available from website: https://folk.uio.no/ohammer/past/

Hammer, Ø., Harper, D.A.T. & Ryan, P.D. (2001). PAST: Paleontological statistics software package for education and data analysis. *Palaeontologia Electronica* 4(1), 1-9.

IOTC (2019). *Report of the 21st Session of the IOTC Working Party on Tropical Tunas*. Seychelles, 21 - 26 October 2019. IOTC–2019–WPTT21–R[E].

Ito, H. (1972). Distribution of monolete and trilete ferns in eastern Asia and Northern Oceania. *The Journal Japanese Botany* 37,455-462.

Ito, H. (1978). Distribution of two spore patterns in ferns floras of the world (A preliminary survey). *The Journal Japanese Botany* 47, 321-326.

Krug, A.Z., Jablonski, D., & Valentin, J.W. (2008). Species-genus ratios reflect a global history of diversification and range expansion in marine bivalves. *Proceedings of the Royal Socociety B*, 275, 1117-1123. https://doi.org/10.1098/rspb.2007.1729.

Pérez Hernández, C.X. (2019). Distintividad taxonómica: Evaluación de la diversidad en la estructura taxonómica en los ensambles. In C.E. Moreno (Ed) *La biodiversidad en un mundo cambiante: Fundamentos teóricos y metodológicos para su estudio.* Universidad Autónoma del Estado de Hidalgo/Libermex, Ciudad de México, pp. 285-306.

Pielou, E.C. (1975). *Ecological diversity*. Wiley, New York. 165 pp. https://doi.org/10.4319/lo.1977.22.1.0174b

PPG I (2016). A community-derived classification for extant lycophytes and ferns. *Journal of Systematics and Evolution*, 54, 563–603. doi: https://doi.org/10.1111/jse.12229

Rivas Martínez, S. (2004). Global Bioclimatics (Clasificación Bioclimática de la Tierra). https://www.globalbioclimatics.org/book/bioc/global_bioclimatics-2008_00.htm

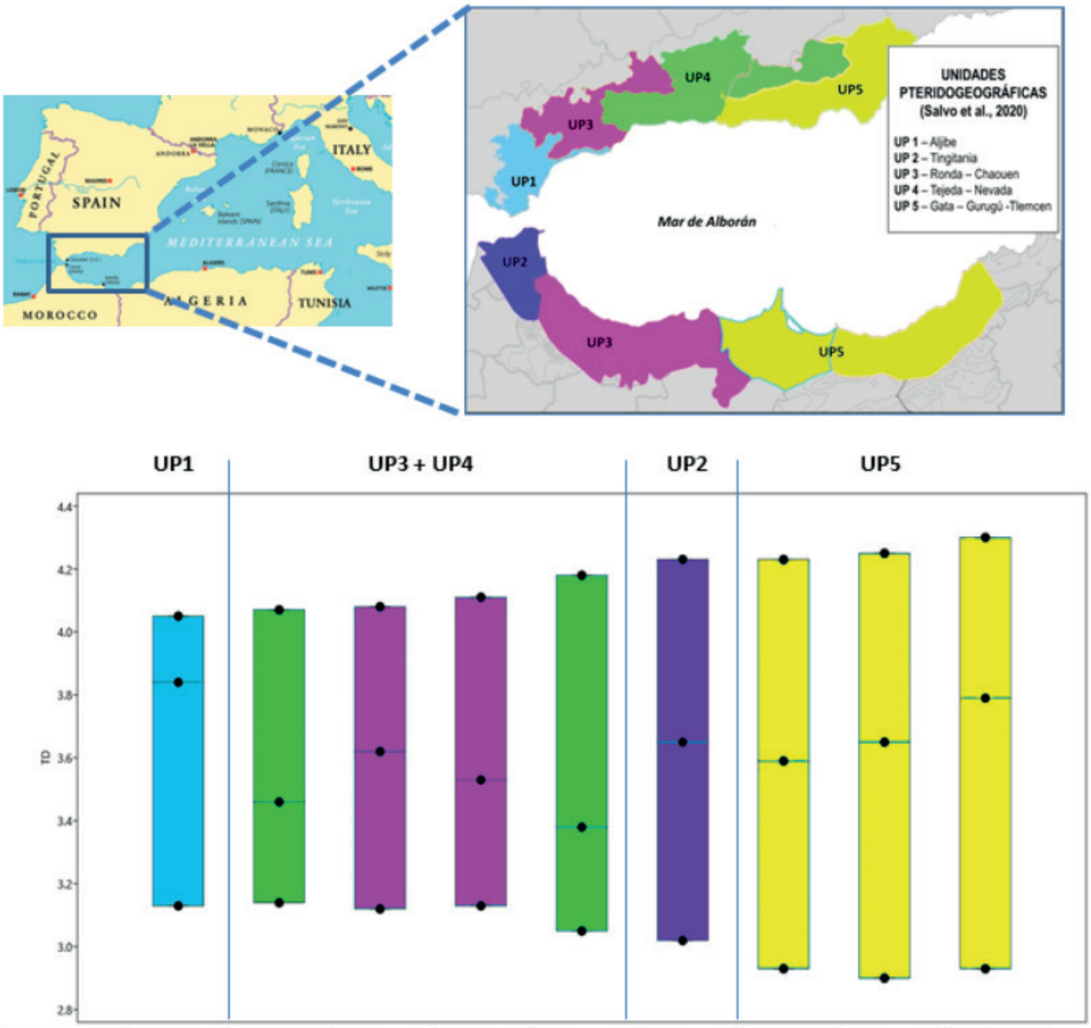
Salvo Tierra, Á.E., Melero-Jiménez, I.J., García-Sánchez, J., Báez, J.C., & Flores-Moya, A. (2020). Biogeografía analítica de la pteridoflora del arco de alborán: consecuencias para su status de protección. *Acta Botánica Malacitana,* 43: 1-19 and Atlas. https://doi.org/10.24310/Actabotanicaabmabm.v45i.7743.

Tucker, C.M., Cadotte, M.W., Carvalho, S.B., Davies, J., Ferrier, S., Fritz, S.A., Grenyer, R., Helmus, M.R., Jin, L.S., Mooers, A.O., Pavoine, S., Purschke, O., Redding, D.W., Rosauer, D.F., Winter, M. & Mazel, F. (2017). A guide to phylogenetic metrics for conservation, community ecology and macroecology. *Biological reviews of the Cambridge Philosophycal Society* 92(2), 698- 715. DOI: 10.1111/brv.12252

Vane-Wright, R. I., C. J. Humphries & P. H. Williams. (1991). What to protect?- Systematics and the agony of choice. *Biological Conservation* 55, 235-254. https://doi.org/10.1016/0006-3207(91)90030-D

Warwick, R.M. & Clarke, K.R. (1995). New 'biodiversity' measures reveal a decrease in taxonomic distinctness with increasing stress. *Marine Ecology Progress Series* 129, 301-305. https://doi.org/10.3354/meps129301.

Yoshioka, P.M. (2008). Misidentification of the Bray-Curtis similarity index. *Marine Ecology Progress Series* 368, 309–310.



	Aljibe	Nevada	Chauen	Ronda	Tejeda	Tingitania	Tlemcen	Gurugú	Gata
Distinctness	3.84	3.46	3.62	3.53	3.38	3.65	3.59	3.65	3.79
Lower limit	3.13	3.14	3.12	3.13	3.05	3.02	2.93	2.90	2.93
Upper limit	4.05	4.07	4.08	4.11	4.18	4.23	4.23	4.25	4.30

Figure 1.- Location of the study area and the operating geographic units (OGU) The Δ+ index plotted for each locality, ordered from lowest to highest according to their range of distinction (difference between the upper and lower limit) and identification according to the Pteridogeographic Units of Salvo Tierra et al. (2020).

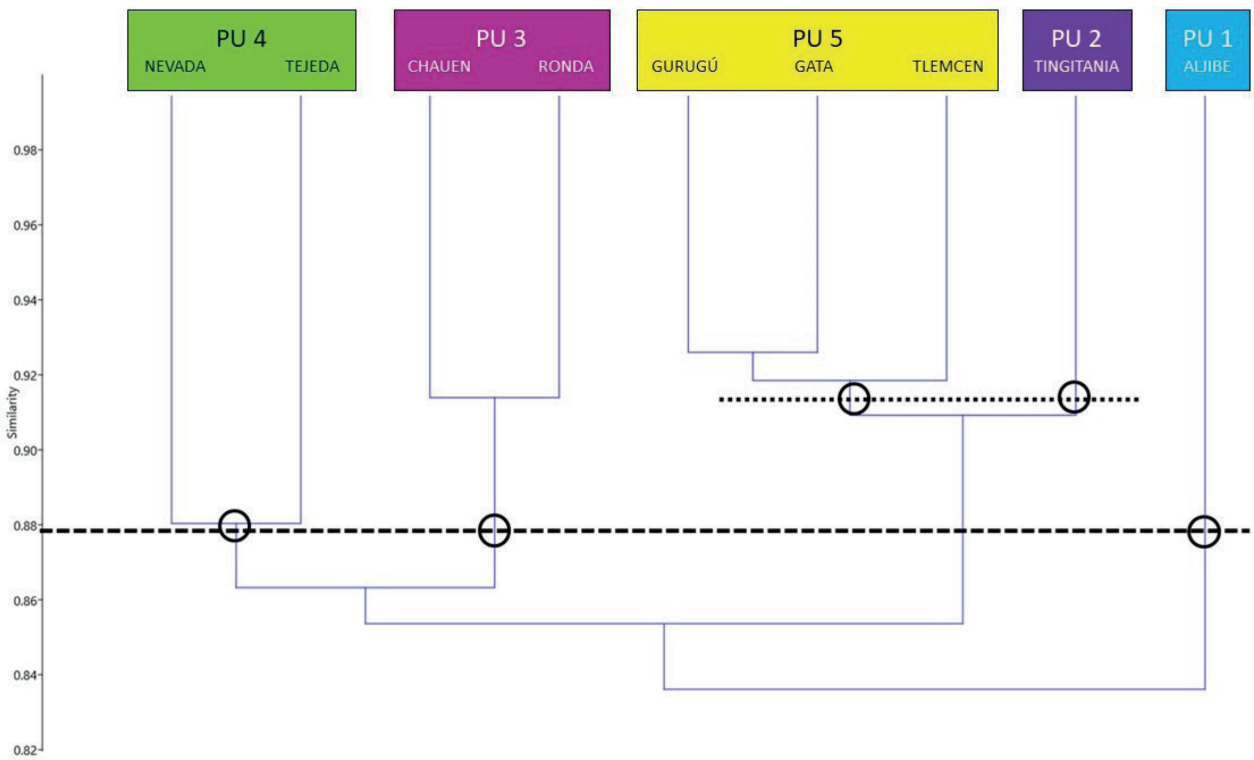


Figure 2.- Dendrogram of the OGUs in the Alboran Arc carried out with UPGMA based on the similarity calculated with the similarity index of Bray & Curtis (Correlation coefficient 88.8%; Phenon line at 88%) (PU1: Aljíbica Unit, PU 2: Tingitania Unit, PU 3. Chauen-Ronda Unit, PU 4. Tejeda-Nevada Unit, PU 5. Gurugú-Gata-Tlemcen Unit)

Table 1.- Values for each of the analyzed OGUs: TD, geographical references, pteridofloristic index (ºploidy: ploidy grade; m/t: index monolete/trilete) and tracks generalized (CIR: Circumboreal; ENMED: Mediterranean endemisms; HET: Heterochoric; LAT: Latimediterranean; MROP: Mediterranean and neighboring eastern regions; REPAME: Paleomediterranean relicts; SUBMED: Submediterranean; SUBTROP: Subtropical)

	TD		**Geographical references**			**Pteridofloristic index**			**Tracks generalized**							
	Value	Range (Dif Ul-Ll)	Longitude	Latitude	Maximum elevation	Specific richesse	ºploidy	m/t	HET	CIR	SUBTROP	LAT	MROP	SUBMED	ENMED	REPAME
Aljibe	3,84	0,92	5,29	36,11	1092	46	2,78	1,09	15,22	13,04	6,52	19,57	6,52	19,57	4,35	13,04
Chauen	3,62	0,96	5,12	35,1	2159	41	3,07	1,28	19,51	17,07	2,44	17,07	9,76	17,07	12,20	4,88
Gata	3,79	1,37	1,53	36,59	562	23	2,87	0,64	17,39	13,04	4,35	17,39	8,70	30,43	4,35	4,35
Gurugú	3,65	1,35	2,57	35,16	890	22	3,09	1,00	31,82	9,09	0,00	13,64	4,55	22,73	4,55	13,64
Nevada	3,46	0,93	3,26	37,9	3749	46	3,22	1,71	17,39	23,91	2,17	23,91	6,52	17,39	4,35	2,17
Ronda	3,53	0,98	5,07	36,37	1919	40	3,05	1,22	20,00	15,00	2,50	22,50	7,50	20,00	5,00	7,50
Tejeda	3,38	1,13	3,46	36,52	2066	33	3,21	1,75	21,21	21,21	3,03	24,24	9,09	15,15	3,03	3,03
Tingitania	3,65	1,22	5,28	35,47	1362	30	2,53	1,00	20,00	10,00	3,33	26,67	6,67	13,33	10,00	10,00
Tlemcen	3,59	1,30	1,26	34,45	1418	26	3,08	1,00	23,08	3,85	0,00	23,08	7,69	26,92	7,69	7,69

SUPPLEMENTARY DATA - Checklist of pteridophytes from the Gibraltar Arch ordered according to the PGP1 (2016) systematics and presence (1) / absence (0) for the OGUs studied.

ORDER	**FAMILY**	**GENUS**	**SPECIEs** *(incl. subspecies recognized as species by some authors)*	CODE	Tingitania	Chauen	Gurugú	Tlemcen	Aljibe	Ronda	Tejeda	Nevada	Gata
Isoëtales	Isoëtaceae	*Isoëtes*	*Isoëtes durieui* Bory	ISO DUR	0	0	0	1	1	1	0	0	0
			Isoëtes histrix Bory	ISO HIS	1	0	0	1	1	1	0	0	1
			Isoëtes tiguliana Gennari	ISO TIG	0	1	0	0	1	0	0	0	0
			Isoëtes velata A. Braun	ISO VEL	0	0	0	0	1	0	0	1	0
Selaginellales	Selaginellaceae	*Selaginella*	*Selaginella balansae* (A. Braun) Heiron.	SEL BAL	0	1	1	0	0	0	0	0	0
			Selaginella denticulata (L.) Spring.	SEL DEN	1	1	1	1	1	1	1	1	1
Equisetales	Equisetaceae	*Equisetum*	*Equisetum arvense* L.	EQU ARV	0	0	0	0	0	0	1	1	1
			Equisetum ramosissimum Desf.	EQU RAM	1	1	1	1	1	1	1	1	1
			Equisetum telmateia Ehrh.	EQU TEL	1	1	1	0	1	1	1	1	1
Ophioglossales	Ophioglossaceae	*Botrychium*	*Botrychium lunaria* (L.) Swatrz	BOT LUN	0	1	0	0	0	0	1	1	0
		Ophioglossum	*Ophioglossum lusitanicum* L.	OPH LUS	1	1	0	1	1	1	0	1	1
			Ophioglossum vulgatum L.	OPH VUL	0	1	0	0	0	0	0	1	0
Psilotales	Psilotaceae	*Psilotum*	*Psilotum nudum* (L.) P. Beauv.	PSI NUD	0	0	0	0	1	0	0	0	0
Osmundales	Osmundaceae	*Osmunda*	*Osmunda regalis* L.	OSM REG	1	1	1	0	1	1	0	0	0
Hymenophyllales	Hymenophyllaceae	*Vandenboschia*	*Vandenboschia specio-sa* (Willd.) Kunkel	VAN SPE	0	0	0	0	1	0	0	0	0
Cyatheales	Culcitaceae	*Culcita*	*Culcita macrocarpa* C. Presl	CUL MAC	0	0	0	0	1	0	0	0	0

Polypodiales	Aspleniaceae	*Asplenium*	*Asplenium adiantum-nigrum* L.	ASP ADI	1	1	0	1	1	1	0	1	0
			Asplenium ceterach L.	CET OFF	1	1	1	1	1	1	1	1	1
			Asplenium csikii Kümmerle & András.	ASP PAC	0	1	0	0	0	0	1	1	0
			Asplenium fontanum (L.) Bernh.	ASP FON	0	0	0	0	1	0	0	0	0
			Asplenium foreziense Magnier	ASP FOR	0	0	0	0	0	0	0	1	1
			Asplenium hemionitis L.	ASP HEM	1	0	1	1	0	0	0	0	0
			Asplenium hispanicum (Coss.) Greuter & Burdet	PLE HIS	0	1	0	1	0	1	1	1	0
			Asplenium marinum L.	ASP MAR	1	0	1	0	1	0	0	0	0
			Asplenium obovatum Viv. subsp. *obovatum*	ASP OBO	1	1	0	0	0	0	0	0	1
			Asplenium obovatum Viv. subsp. *billotii* (Schultz) Kerg.	ASP BIL	1	1	1	1	1	1	1	1	1
			Asplenium onopteris L.	ASP ONO	1	1	1	1	1	1	1	1	1
			Asplenium petrarchae (Guérin) DC.	ASP PET	0	1	1	0	1	1	1	1	1
			Asplenium ruta-muraria L.	ASP RUT	0	1	0	0	0	1	1	1	1
			Asplenium sagittatum (DC.) Bange	PHY SAG	1	1	0	1	1	1	0	0	0
			Asplenium scolopendrium L.	PHY SCO	1	1	0	1	1	1	1	1	0
			Asplenium septentrionale (L.) Hoffm.	ASP SEP	0	1	0	0	0	0	0	1	0
			Asplenium trichomanes L.	ASP TRI	1	1	1	1	1	1	1	1	1
			Asplenium viride Hudson	ASP VIR	0	0	0	0	0	0	0	1	0
	Athyriaceae	*Athyrium*	*Athyrium filix-femina* (L.) Roth	ATH FIL	1	0	0	0	1	1	1	1	0
		Diplazium	*Diplazium caudatum* (Cav.) Jermy	DIP CAU	0	0	0	0	1	0	0	0	0
	Blechnaceae	*Struthiopteris*	*Struthiopteris spicant* (L.) F.W. Weiss	BLE SPI	1	1	0	0	1	1	0	0	0

Polypodiales	Cystopteridaceae	Cystopteris	*Cystopteris dickieana* R. Sim	CYS DIC	0	1	1	1	1	1	1	1	0
			Cystopteris fragilis (L.) Bernh.	CYS FRA	0	1	1	1	1	1	1	1	0
			Cystopteris viridula (Desv.) Desv.	CYS VIR	0	0	0	0	0	1	0	1	0
		Gymnocarpium	*Gymnocarpium robertianum* (Hoffm.) Newman	GYM ROB	0	0	0	0	0	0	1	0	0
	Davalliaceae	*Davallia*	*Davallia canariensis* (L.) Sm.	DAV CAN	1	1	1	0	1	1	0	0	0
	Polypodiaceae	*Polypodium*	*Polypodium cambricum* L.	POL CAM	1	1	1	1	1	1	1	1	1
			Polypodium interjectum Shivas	POL INT	0	1	0	0	1	1	0	1	0
			Polypodium vulgare L.	POL VUL	0	0	0	0	0	0	1	1	0
	Thelypteridaceae	*Thelypteris*	*Thelypteris palustris* Schott	THE PAL	0	0	0	0	1	0	0	0	0
		Cyclosorus	*Cyclosorus dentatus* (Forssk.) Ching	CHR DEN	0	0	0	0	1	0	0	0	0
	Dennstaedtiaceae	*Pteridium*	*Pteridium aquilinum* (L.) Kuhn	PTE AQU	1	1	1	1	1	1	1	1	0

Polypodiales	Pteridaceae	*Adiantum*	*Adiantum capillus-veneris* L .	ADI CAP	1	1	1	1	1	1	1	1	1
		Oeosporangium	*Oeosporangium pteridioides* (Reichard) Fraser-Jenk. & Pariyar subsp. *acrosticum* (Balb.) Fraser-Jenk. & Pariyar	CHE ACR	1	1	0	1	1	1	1	1	1
			Oeosporangium guanchicum (Bolle) Fraser-Jenk. & Pariyar	CHE GUA	0	1	1	1	1	1	1	1	1
			Oeosporangium hispanicum (Mett.) Fraser-Jenk. & Pariyar	CHE HIS	0	1	0	1	0	1	0	1	0
			Oeosporangium pteridioides (Reichard) Fraser-Jenk. & Pariyar *subsp. pteridioides*	CHE MAD	0	1	1	1	1	1	1	1	1
			Oeosporangium tinaei (Tod.) Fraser-Jenk.	CHE TIN	0	0	0	0	0	1	0	0	0
		Anogramma	*Anogramma leptophylla* (L.) Link	ANO LEP	1	1	1	1	1	1	1	1	1
		Cosentinia	*Cosentinia vellea* (Aiton) Tod.	COS VEL	1	1	1	1	1	1	1	1	1
		Cryptogramma	*Cryptogramma crispa* (L.) R. Br. ex Hook.	CRY CRI	0	0	0	0	0	0	0	1	0
		Paragymnopteris	*Paragymnopteris marantae* (L.) K.H. Shing	NOT MAR	0	1	0	0	1	1	0	0	0
		Pteris	*Pteris incompleta* Cav.	PTE INC	1	0	0	0	1	0	0	0	0
			Pteris vittata L.	PTE VIT	1	1	0	0	1	1	1	1	1

Polypodiales	Dryopteridacae	*Dryopteris*	*Dryopteris affinis* (Lowe) Fraser-Jenkins	DRY AFF	0	0	0	0	1	1	1	1	0
			Dryopteris borreri (Newman) Oberh. & Tavel	DRY BOR	0	0	0	0	0	0	1	1	0
			Dryopteris filix-mas (L.) Schott	DRY FIL	0	1	0	0	1	1	1	1	0
			Dryopteris guanchica Gibby & Jermy	DRY GUA	0	0	0	0	1	0	0	0	0
			Dryopteris mindshelkensis N.Pavl.	DRY SUB	0	0	0	0	0	0	1	1	0
			Dryopteris tyrrhena Fraser-Jenkins & Reichst.	DRY THY	0	0	0	0	0	0	0	1	0
		Polystichum	*Polystichum aculeatum* (L.) Roth	POS ACU	0	1	0	1	0	1	1	1	0
			Polystichum lonchitis (L.) Roth	POS LON	0	0	0	0	0	0	0	1	0
			Polystichum setiferum (Forssk.) Woyn.	POS SET	1	1	0	0	1	1	0	1	0
Salviniales	Marsileaceae	*Marsilea*	*Marsilea strigosa* Willd.	MAR STR	1	0	0	0	0	0	0	0	1
		Pilularia	*Pilularia minuta* Durieu	PIL MIN	1	0	0	0	0	0	0	0	0