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Distribution, status and conservation of rare relict plant species in the Valencian Community

Abstract

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The Valencian Community is home to approximately 3050 vascular plant species, of which 23 can be considered endangered relict species. Its distribution follows distinct geographical patterns that determine the disturbances to which different taxa are subject. In the studied species, rarity is inextricably linked to their evolutionary history, but human intervention and issues such as land use have had a significant impact in their current status. Habitat loss is the issue perceived as more pressing with regard to their conservation. Many relict taxa will only survive if interactions between disturbance agents are acknowledged. Conservation of relicts requires a long-term fine-scale approach to management in which the maintenance of heterogeneous landscapes must be recognised as a crucial strategy.

Introduction

The Valencian Community (VC), at the eastern part of the Iberian Peninsula, shelters ca. 3050 vascular plant species, among which a small number can be considered relict taxa (Mateo & Sanz 1998; Laguna & al. 1998). The causes for the presence of these species are paleohistoric. The VC has been colonized by a diversity of floristic contigents such as the irano-turanian or the saharo-sindian approximately 6,5 million years ago (Costa 1986, 1999). Subsequently, glacial periods during the quaternary era promoted the reception of species from cooler and wetter environments. Before these events, lush lauroid forests covered the VC during the Tertiary (Gomez-Campo & Malato-Beliz 1985). Some of these taxa survive as small populations of extremely local occurrence (Alcober & al. 1988) many of which are threatened by a plethora of disturbances, mainly anthropogenic, in addition to the genetic constraints imposed by the low number of individuals within populations (Lesica & Allendorf 1992; Primack 2002).

The present study was undertaken to address the following questions: which is the number of populations of our relict species? How are they distributed? Do relict species share the same habitats? Are they all subjected to the same disturbances? Is there a linkage between relict distribution and types of disturbance affecting them? Do all share

the same management needs? The final aim was to identify the features most at risk and to develop ways to assure entities survival.

Material and methods

Distribution of relict species versus spatial distribution of land uses in the Valencian Community

Fieldwork was carried out in order to accurately map the species (1 km UTM square grid) whose distribution data were vague or which showed the most restricted distributions. For species showing a discontinuous or inaccessible distribution the number of individuals was either counted directly or estimated from transepts and partial counts. The biotopes where species occur were characterised, the specific threats assessed and the assigned IUCN red data book categories were revised and updated. For these tasks the authors visited a large part of the territory covered in this study. Distribution records of the studied taxa were transposed onto 1:50000 topographic maps and digitised into a geographic information system (Arcview GIS v3.2a for windows). Thus as a first step, and using full distribution ranges, the pattern of pockets of refugial habitat and relictual taxa was obtained.

Subsequently, this pattern was collated with 4 polygonal data themes — population density, land use, forest fires, intensive agriculture — which provided additional information on the distribution of the major disturbances affecting conservation of relict taxa.

Technical concept of plant microreserves

Plant Microreserves (PMRs) are small land plots (up to 20 ha) of peak value in terms of criteria such as plant species richness endemism or rarity, given over to long term monitoring and conservation of plant species and vegetation types. PMRs represent a network of plots mainly located in public land, although they can also be established on private grounds, by means of permanent and irrevocable contracts with landowners. These contracts cater for the need to provide incentives for those who wish to manage their properties on behalf of plant species, so that they are not deterred by the cost of doing so (Wilcove & Chen 1998; Ruecker & Wittman 1995).

The Regional Environmental Council by means of a Decree (Annon. 1994) created this new protection figure. The legal frame confers PMRs a permanent status and provides strong protection to the plants and substrate while allowing traditional activities compatible with plant conservation. According to IUCN criteria, PMRs would fall into type Ib and IV categories.

PMRs are not to be considered Natural Protected Areas (NPAs), but permanent plots for plant conservation in which protection of the substrate is a means to achieve this goal. In contrast with classical NPAs, PMRs need not await the approval of laborious management plans, so that their declaration decrees can simultaneously approve the boundaries of the protected area and the management plan itself. Once approved PMRs are clearly labelled with boundary landmarks. PMRs are not a passive method to protect vegetation, they are designed to conserve vegetation and to develop or test active conservation methods that bring together ex situ and in situ actions in addition to educational activities.

Results

Distribution of relict contingents in the Valencian Community

The distribution of the different floristic relict contingents in the VC is determined by its climatic characteristics. The VC is under the influence of the Föhn effect, which induces overheating and drying of dominant western winds. This results into an overall aridity of the territory. Precipitation increases from south to north, although this is mitigated locally by geographical accidents or moist coastal winds. For instance, the Nao Cape area, which penetrates deep into the mediterranean, receives the most copious precipitation of the VC. Mean temperatures gradually increase from north to south and from east to west.

Following this climatic pattern, most eurosiberian relics concentrate in the highest mountain ranges, located northwest of the territory. This geographic situation allows these mountains to capture the last amounts of precipitation carried by dominant western winds.

Higher pluviometry combined with lower temperatures has allowed the permanence of a rich eurosiberian flora in these mountains. North african and irano-turanian taxa concentrate in the southernmost tip of the VC, where precipitation is lowest and temperatures highest. Lauroid species occur in deeply shaded enclaves or mountain brooks in the Marina Alta area, a region with abundant moisture and mild temperatures (Fig. 1).

Habitat types occupied by relict species

The 23 relict species present in the VC occur in 18 of the habitat types listed in the interpretation manual of EU habitats (Table1). Forested ecosystems — *Tilio-Acerion*, Mediterranean black pine and *Taxus baccata* (*Violo willkommii-Quercetum fagineae Pinetosum salzmannii*), or *Quercus* (*Hedero helicis-Quercetum rotundifoliae*) — hold 30.44% of the studied species. An equal share of species can be found in matorral formations. Some relicts (26.1%) are grassland dwellers, be it pseudo steppe (*Thero-Brachypodietea*), siliceous *Festuca indigesta* formations or *Molinia* (*Scirpo-holoschoenion*) meadows. Finally, Salt marshes (*Juncetalia*) and steppes (*Limonietalia*) and rocky habitats — sea cliffs and siliceous and eutric scree — harbour 13% and 9% of the studied species (For a description of habitats see Interpretation manual of EU habitats).

Conservation status of relict species

The studied relict taxa are threatened to a different degree (Table 1). While 30% are critically endangered (CR), 43% are endangered (EN) and 26% are vulnerable (VU).

Habitat loss, continuous population decline, fragmentation and extremely reduced population sizes can be considered the main causes responsible for their current status.

Disturbances affecting relict contingents

Over 60% of the eurosiberian species are affected by forestry practices. Forest fires are also of importance to these species and perhaps even more damaging, not because of fire but owing to the subsequent loss of soil, which renders potential habitats into steppes in a matter of years. Cattle grazing and trampling by visitors also impact half of the studied species. Finally, neither agricultural practices nor land claim affect any of the studied

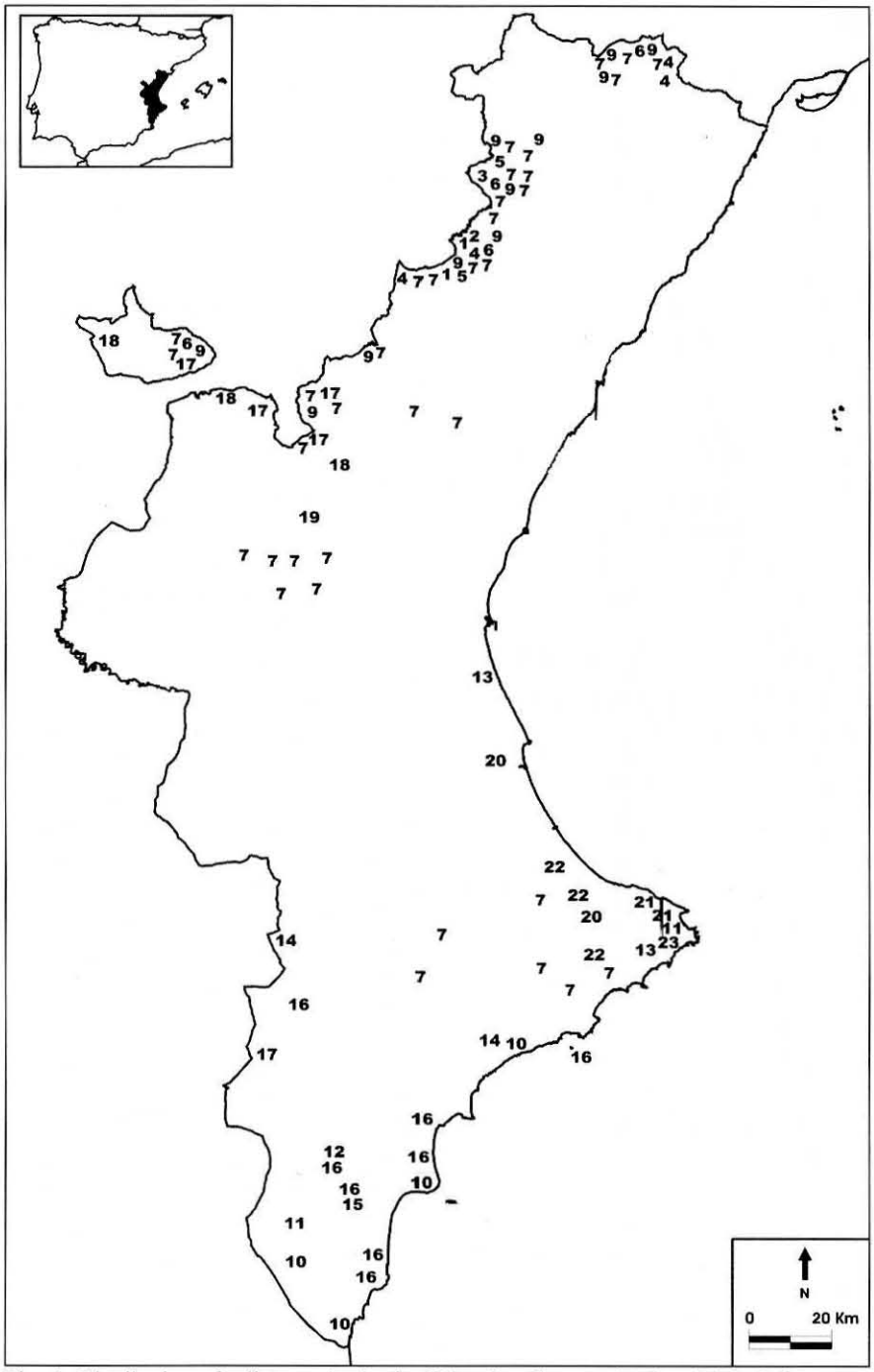

Fig. 1. Distribution of relict species in the Valencian Community (see Table 1 for corresponding species).

eurosiberian species (Table 1).

On the other hand, construction of new housing and its associated land claim affects over 40% of the North-African, Irano-Turanian and Lauroid species, followed by intensive agriculture, which impacts over a third of the studied species. Forestry practices impact over 20% taxa. Finally, plant collection affects a tertiary relict, *Pteris vittata*, a much-sought spectacular fern species (Crespo & al. 1989). Cattle grazing or trampling affect no species in this group (Table 1).

Table 1. Number of individuals, number of populations, total area size of the different populations, Habitats Directive code, IUCN category and type of disturbance affecting each of the endangered relict plants of the Valencian Community.

N°	Species	N° of individuals	N° of populations	Σ area populations	Habitats Directive Code	IUCN Category	Type of disturbance
1	*Anemone nemorosa*	<2500	8	<5 Ha	9180*	EN (C2a)	1,3,6
2	*Vaccinium myrtillus*	<1000	2	<2 Ha	6160	EN (C2a)	1,3,6
3	*Luzula sylvatica*	<50	1	<200m^2	9180*	CR (C2a,b D)	1,3,6
4	*Pyrola chlorantha*	<1000	3	<5 Ha	9530*	VU (C2a D2)	3,6
5	*Galanthus nivalis*	<3000	3	<1 Ha	6410	EN (B1+2c)	1,3,7
6	*Parnassia palustris*	<500	3	<2 Ha	6420	EN (C2a)	5
7	*Taxus baccata* (1)	<3000	44	<12 Ha	9580*	VU (C2a)	1,6
8	*Tilia platyphyllos*	<100	16	<5 Ha	9180*	VU (D2)	3,6
9	*Monotropa hypopitys*	<500	13	<3 Ha	9530*	VU (C2a)	3,6
10	*Launaea arborescens*	<50	3	<1 Ha	5330	CR (B1+2c, C2a)	2,3,4
11	*Maytenus senegalensis* subsp. *europaeus*	<250	2	<1 Ha	5330	CR (B1+3b, C2a, D)	4
12	*Anarrhinum fruticosum*	<200	1	<500m^2	5330	CR (B1+3b,C2b)	3,4
13	*Boerhavia repens*	<50	1	<50 m^2	6110*/8210	CR (C2b, D)	5
14	*Callipeltis cucullaria*	<1000	2	<1 Ha	8120	VU (D1+2)	5
15	*Halopeplis amplexicaulis*	<5000	2	<1 Ha	1420	EN (B1+3d)	2
16	*Cynomorium coccineum* (1)	<2000	14	<5 Ha	1420/1510*	VU (C2a)	2,4
17	*Saponaria glutinosa*	<500	6	<3 Ha	5330/6220	EN (C2a)	3,6
18	*Rochelia disperma*	<500	4	<1 Ha	6220	EN (C2a)	6
19	*Garidella nigelastrum*	<600	5	<2 Ha	5330	CR (A1a)	2
20	*Laurus nobilis* (1)	<100	4	<4 Ha	*5230/9340	EN (B1+2c, C2a)	4,6
21	*Ruscus hypophyllum*	<500	2	<2 Ha	5210	EN (B1+2c, C2a	6
22	*Pteris vittata*	<500	6	<1 Ha	7220*	EN (C2a)	2,7
23	*Asplenium marinum*	<50	1	<200 m^2	1240	CR (C2b, D)	--

Species: (1) included in the Valencian Community Catalogue of Threatened Species (Annon. 1985). 1. Cattle grazing/Visitor trampling; 2. Agriculture; 3. Forestry practices; 4. Land claim; 5. Quarrying; 6. Forest fires; 7. Plant collection.

Characterisation of land uses in the Valencian Community.

Intensive uses of the territory —industrial, tourist, and horticultural — are concentrated in coastal areas. In fact, 48% of the soil given up to residential uses in the VC is concentrated in coast, which accounts to a mere 14% of the available land. An additional disturbance agent is intensive agricultural farming practices. These activities, mainly concentrated in the southern limit of the VC as well as the Valencia plain, severely modify the landscape and rely on irrigation and heavy use of chemicals. On the other hand inland territories have extensive agriculture as well as livestock husbandry as their mainstay.

Discussion

The distribution of relict contingents in the VC follows a distinct geographical pattern that determines the disturbances to which different taxa are subjected. In the studied

species, rarity is inextricably linked to their evolutionary history, but human intervention and issues such as land use have had a significant impact in their current status.

Relicts are impacted by sets of exogenous disturbances (McIntyre & Hobbs 1999) with a synergic effect. Patches of vegetation left over after urbanisation in Alicante suffer from quarrying, trampling and neophyte invasion. Wild fires, cattle grazing, and forestry practices affect Eurosiberian-rich mountain areas. In agricultural ecosystems, changes in cultures imply altered water balance, new competitive weeds and changes in culture practices. These combinations of exogenous disturbances eventually lead to habitat destruction or to a more severe degradation (Yates & Hobbs 1997), rendering pockets of refugial habitat unable to sustain their former vegetation.

Therefore, conservation of relicts in the VC requires prevention of habitat loss. The Regional Environmental Council is striving to protect habitats rich in relicts with PMRs.

The scattered distribution of relicts together with the fact that they appear in a wide diversity of habitats hampers the task of encompassing a high number of these taxa with large natural protected areas. An additional difficulty is the intrinsic properties of the mediterranean landscape (Blondel & Aronson 1999), highly dissected with thousands of small private properties. PMRs cope well with these difficulties as they can be established on private grounds. Once declared, a conservation protocol is designed for the target species in each PMR. Activities include plant census, neophyte removal, cattle exclosure, propagule collection and storage, population reinforcements, undergrowth removal, habitat restoration etc. The PMR network has allowed identifying the natural patrimony at risk so that resource development can expand without compromising floristic richness.

To summarise, habitat loss is the issue perceived as more pressing with regard to relict plant conservation. Disturbance poses an important problem for the conservation of relict plants in the VC: many relict taxa will only survive if interactions between disturbance agents are acknowledged. Conservation of relicts requires a long-term fine-scale approach to management in which the maintenance of heterogeneous landscapes must be recognised as a crucial strategy.

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