Floristic Analyses of the Corsican Flora: Distribution in Ecological Compartments (Vegetation Belts, Habitats and Substrates)

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Floristic analyses of the Corsican flora: distribution in ecological compartments (vegetation belts, habitats and substrates)

André Schlüssel, Daniel Jeanmonod & Jacques Gamisans

Abstract

SCHLÜSSEL, A., D. JEANMOND & J. GAMISANS (2014). Floristic analyses of the Corsican flora: distribution in ecological compartments (vegetation belts, habitats and substrates). *Candollea* 69: 25-43. In English, English and French abstracts.

This article analyzes partial data published in the "Flora Corsica" in order to characterize the Corsican vascular flora. These analyses focus on different aspects of the flora such as species richness, taxonomic distribution, abundance and life-forms at different vegetation belts, habitats and substrates. The results are compared with other geographic regions, particularly from the European Mediterranean and adjacent areas. The decrease of species richness with an increase of altitude as well as the sharp decrease of *Fabaceae* has been confirmed. Regarding the biological spectrum, the decrease of the therophytes with an increase of altitude is obvious and compensated by the increase of the hemicryptophytes. On Corsica several peculiarities have been highlighted in the different ecological compartments: 1. the littoral and the cryo-oromediterranean belts appear to be very different from the others in many features; 2. the rocky habitats are shown to be especially important for the diversity of families such as *Poaceae* and *Caryophyllaceae;* 3. calcareous areas are shown to be extremely important for the alpha diversity as well as for the restricted range taxa. Finally, the specificity of the flora growing on the ultramafic outcrops is confirmed and emphazised.

Key-words

Corsica – Diversity – Ecology – Floristics – Life-forms – Mediterranean – Mountains –Serpentinites – Vegetation belts

Résumé

SCHLÜSSEL, A., D. JEANMONOD & J. GAMISANS (2014). Analyse floristique de la flore corse: répartition dans divers compartiments écologiques (étages de végétation, milieux et substrats). *Candollea* 69: 25-43. En anglais, résumés anglais et français.

Cet article analyse quelques-uns des résultats publiés dans la «Flora Corsica» dans le but de caractériser la flore des plantes vasculaires de Corse. Cette analyse est centrée sur la richesse spécifique, la distribution taxonomique, l'abondance des espèces, les formes biologiques dans les divers étages de végétation, mais aussi dans les habitats et les types de substrats. Les résultats sont comparés à d'autres régions géographiques, en particulier en zone méditerranéenne européenne et dans des régions adjacentes. La diminution de la richesse spécifique avec l'augmentation de l'altitude est confirmée, avec notamment une nette diminution des *Fabaceae*. Pour les types biologiques, la diminution du nombre de thérophytes avec l'augmentation de l'altitude est évidente et compensée par un accroissement des hémicryptophytes. En Corse, plusieurs particularités ont été mises en évidence dans les divers compartiments écologiques: 1. le littoral et l'étage cryo-oroméditerranéen apparaissent comme très distincts des autres sur plusieurs caractéristiques; 2. les habitats rocheux montrent une diversité particulièrement importante des *Poaceae* et *Caryophyllaceae;* 3. les zones calcaires apparaissent comme très importantes pour l'alphabiodiversité et pour les taxons à aire particulièrement réduite. Enfin, la spécificité de la flore croissant sur des substrats ultramafiques est mise en évidence.

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Introduction

Following the publication of "Flora Corsica" (Jeanmonod & Gamisans, 2007), we undertook several analyses of the Corsican flora using the characteristics related to each taxon. After a first publication (Jeanmonod & al., 2011a) dealing with the general characteristics of the flora (species richness, taxonomic distribution, abundance, life-forms and phenology) and a second publication focusing on the alien flora of the island (Jeanmonod & al., 2011b), herein we analyze the distribution of the flora in the different ecological compartments of the island, namely the vegetation belts, the various habitats, and the major types of substrates. The purpose is to characterize the differences between these compartments and to explore whether they correlate with other general trends by comparing our data, whenever possible, with that from other geographic regions.

Concerning the vegetation belts six main issues are addressed:

1. Following some authors (Gamisans, 1991; Thompson, 2005), can we confirm that the species richness decreases gradually from the lowest vegetation belts to those at higher altitude? If so, is it due to a simple altitudinal (climatic) effect or to the fact that the area occupied by these floors also decreases with the increase of altitude?
2. Do we observe a change in the frequency pattern in the successive vegetation belts? Considering the gradual decrease of the surface of these belts, we should expect to find more rare or localized taxa in higher altitudes.
3. Does the life forms pattern follow the pattern observed in the Alps (Aeschimann & al., 2012) or it is a specific and rather exclusive pattern?
4. Does the habitats pattern correspond to the general idea we have: thermo- and mesomediterranean belts dominated by shrubs and ruderal plants, supra-mediterranean and mountain belts with mainly forest plants, a coastal and alpine belt dominated by rupicolous plants? Is there an increase (or decrease) of habitats with altitude?
5. Which habitats are the richest ones in terms of number of taxa?
6. Concerning the bedrocks, which are very unevenly distributed on the island, two main issues are addressed: do the various substrates show the same pattern of life forms and whether the rarest substrates hold the rarest taxa?

Materials and methods

Treated taxa

The analyses are based on the data extracted from Jeanmonod & Gamisans (2007). Data from more recent works (Jeanmonod & Schlüssel, 2008, 2010, 2012) has not been included to ensure that a consistent set of data from a specified time period, and based on a particular reference point, was used. For the reasons discussed in Jeanmonod & al. (2011a), the taxonomic level includes only species and subspecies, but not varieties and forms, with a total of 2680 taxa treated. This number includes both native and introduced taxa (but not the cultivated ones). However, our analyses is only interested, unless otherwise specified, in the indigenous component of the flora, with a total of 2237 taxa.

The plant family concept is based on Cronquist (1981), which has been also commonly used in the published floras of comparable geographic areas. Thus, some families such as the *Liliaceae* and *Scrophulariaceae* are treated here in a broad sense (for more details see Jeanmonod & Gamisans, 2007).

Vegetation belts

Because of its geographical position and its topography, the Corsican vegetation consists of a dual system of vegetation (Gamisans, 1991, Gamisans & Marzocchi, 1996): on the one hand, at low altitude and on the southern slopes of the mountains, several belts correspond to the Mediterranean system, while on the other hand, at high altitude and on the northern slopes of the mountains, belts correspond to the temperate system. Thus, the vegetation of Corsica has been divided into seven belts: thermomediterranean (Tm: 5 m to 10-180 m), mesomediterranean (Me: 5-180 m to 700-900 m), supramediterranean (Sm: 700-900 m to 1000-1350 m), montane (Mo: 900-1350 m to 1600-1800 m), cryo-oromediterranean (Or: 1800 m to 2200 m in south slopes), subalpine (Sa: 1600 m to 2100 m in north slopes) and alpine (Al: > 2100-2200 m). The altitudinal mentions are indicative: for more details and explanations see Jeanmonod et al., 2011. In addition to these belts, and because of its particularities, we also refer to the "coastal zone" or "littoral belt" (Li) that is composed of specific habitat types (rocks, sand dunes, salty soils) subject to sea spray and strong winds. The azonal vegetation types represented by riparian and riverine vegetation (Ri in Jeanmonod & Gamisans (2007)) are assimilated with the belts corresponding to their altitudinal distribution. That is to say that Ri1 is subsumed into the mesomediterranean, Ri2 into the supramediterranean, and Ri3 into the montane belts respectively. In the various analyses (see Figures and Tables below), these belts are always ranked in ascending order, corresponding to their natural altitudinal position. The cryo-oromediterranean belt was placed between the montane and the subalpine belts as its

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altitudinal position is the same as the latter, but it is restricted to south facing slopes. Gamisans (1976, 1979a, 1979b, 1991) highlighted the climatic characteristics of these belts and their vegetation types. We focus on the biotic characteristics of all reported taxa (alpha diversity, life-forms distribution, degrees of abundance) and try to correlate them with ecological factors (altitude, habitats and substrates).

The areas covered by each of the belts was calculated using a numerical model based on the elevations and the slopes (ArcGis) which was used to estimate the percentage of the total area of the island represented by each belt.

Abundance classes

All taxa were divided into seven major abundance classes (as in Gamisans & Jeanmonod, 1993) as follows (ranked by increasing order of rarity): CC = very common; C = common; PF = infrequent or disseminated; LOC = localised (only in small areas, where it can be abundant); R = rare: only 6 to 10 known localities; RR = very rare: only 1 to 5 known localities; D? = probably extinct on Corsica.

Life-forms

Jeanmonod & Gamisans (2007) indicates the life-form of each taxon. The life-forms used in this study correspond to the major groups defined by Raunkiaer (1934), based on the strategy developed by plants (location of the plant growth-point) to survive unfavourable seasons (dry season, cold season), and used in many other floras. These groups are as follows: therophytes, phanerophytes, chamaephytes, hemicryptophytes, geophytes and hydrophytes (including the helophytes). The relative importance of life-forms is important as they play a major role in the composition of functional groups (Brooks & al., 1997; Médail & al., 1998) and demonstrate an affinity with ecological and bioclimatic factors (Daget, 1980). The life-forms thus represent useful descriptors with good predictive powers for assessing the stability and conservation status of Mediterranean habitats (Verlaque & al., 2001).

Habitats

The classification used by Jeanmonod & Gamisans (2007) is based on the major vegetation types. Here this system is simplified by reducing it to 12 habitat categories: a) aquatic, b) semi-aquatic, c) wet herbs, d) riparian (woody vegetation along stream banks), e) sandy, f) rocky, g) meadows and grasslands, h) megaphorbs, i) bushes and shrubs (low ligneous vegetation), j) forests, k) cultivated, and l) ruderal.

Substrates (bedrock)

The bedrock of Corsica is mainly siliceous (67% of the surface). The schists also form a relatively important part of the islands surface (about 15%) but are essentially restricted to the NE of the island. The limestone is localised (2% of the surface) and dispersed, which is also the case with the serpentinites (= ultramafic rocks, < 4%). Finally, the remaining 12% of the surface area is covered with alluvial deposits, which are mainly concentrated on the Oriental coastal plain (*Plaine orientale*) (Gauthier, 2002). Despite their small surface, the serpentinites are very important in terms of the flora and vegetation they host. They show particular physicochemical characteristics such as a high concentration of toxic heavy metals, a very low Ca/Mg ratio (< 1), low concentration of nutrients, strong heat accumulation during sunny days, a tendency to increase water deficit and marked soil erosion. These characteristics are responsible for the development of a specific flora and vegetation (see e.g. Whittaker & al., 1954; Brooks, 1987; Baker & al., 1991; Roberts & Proctor, 1992; Proctor & Woodell, 1995; Kruckenberg, 2002), which is mainly reflected by the presence of many endemic taxa and the development of a low, sparse and species poor vegetation.

In Jeanmonod & Gamisans (2007), the substrate indicated for each taxon is presented in a simplified form. The authors indicate it only when the taxa are associated with limestone, schists or serpentinite. Nothing is mentioned when a taxon is present on siliceous soils or when a taxon is indifferent to the substrate. Thus, the substrate assignment (silica or indifferent) is used by default in our analyses for all taxa where the other three substrates are not mentioned.

Comparisons with other geographical territories

Whenever possible, the results (species richness, proportion of the life-forms, flora of specific bedrocks) are compared with other geographical regions, especially regions with a Mediterranean climate such as Albania (Brooks, 1987; Stevanovi & al., 2003), Crete (Greece) (Turland & al., 1993; Chilton & Turland, 1997), southern France (Médail & Vidal, 1998), Greece (Polunin, 1980; Babalonas, 1984, 1989; Strid & Tan, 1986, 1991; Brooks, 1987; Stevanovi & al., 2003; Constandinidis, 2004; Lafranchis & Sfikas, 2009), mainland Italy (Ferrari & al., 1991; Chiarucci & Dominicis, 2001; Chiarucci, 2004; Selvi, 2007), Portugal (Pinto da Silva, 1965, 1970, 1981; Brooks, 1987; Menezes de Sequeira & Pinto da Silva, 1992; Aguiar Gonçalvez & al., 1998), Sardinia (Baccheta & al., 2007), Spain (Palacios, 1936; Rivas Goday, 1969, 1973, 1974; Rivas Goday & Esteve, 1972; Rivas-Martinez & al., 1973; López Gonzales, 1975; Brooks, 1987; Cabezudo & al., 1989; Villar & al., 2001; Grau & al., 2011), but also regions that are outside the Mediterranean area, such as the Alps (Austria, France,

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Germany, Italy, Lichtenstein, Slovenia, Switzerland; see Reisigl & Pitschmann, 1958; Rübel, 1911; Grabherr & al., 1995; Theurillat & al., 2003; Aeschimann & al. 2004, 2011, 2012), Bosnia (Ritter-Studnicka, 1970a, 1970b; Stevanovi & al., 2003), Bulgaria (Uzunov & Gussev, 2003; Pavlova, 2004, 2010), Galicia (Spain) (Bellot Rodriguez, 1966; Rivas Goday, 1969, 1974; Rivas Goday & Esteve, 1972; Fraga Vila, 1975; Brooks, 1987), the Massif central (France) (Duvigneaud, 1966; Maisonneuve, 1975; Brunerye, 1980) and Serbia (Pavlovi , 1962; Brooks, 1987; Vasi & Dikli , 2001; Stevanovi & al., 2003). The species richness given for the different areas with serpentinites (see some of the authors cited above) has often been modified by us in order to take into account only the strictly (or almost strictly) serpentinicolous taxa. Furthermore, in order to get a complete list of all the taxa growing on ultramafic rocks in Corsica, the data extracted from Jeanmonod & Gamisans (2007) have been completed with those given by Gamisans (2000) who performed 18 phytosociological relevés, and those obtained by studying voucher specimens of plants collected on serpentinites (259 specimens found) and conserved in different herbaria (G, G-BU, LAU, LG, ZT, and the private herbaria of J. Alphand, M. Conrad, G. Bosc and G. Dutartre). In the case of the Alps, the serpentinite areas of the West and East are very distant from each other and show a different floristic composition (Aeschimann & al., 2004). For this reason we split this area into Western and Eastern Alps, with a dividing line going from the easternmost part of the Bodensee (AUT/SUI) to the Lake Como (ITA). This division is based on floristic and biogeographical characteristics, as outlined by Chodat & Pampanini (1902).

Statistical analyses

Comparisons between the different vegetation belts were made taking into account their size. The species-area relationship using a logarithmic scale (see Arrhenius, 1921) was performed, followed by the calculation of the regression line and the coefficient of determination (r^2) (Zar, 1996). The correlations between several variables were tested using the nonparametric Spearman's Rank correlation test (r_s), with a threshold value set at 0.05 (Zar, 1996). χ^2 tests were used to test the dependence between the abundance differences in the vegetation belts.

Results and discussion

1. Vegetation belts

Alpha diversity

By far the richest vegetation belt, in terms of number of taxa (Table 1), is the mesomediterranean belt (73% [calculated on percentage of a total of 2237 taxa; given that a taxon may be present in several belts, the sum of the percentages of all the belts is not equal to 100%, but equals 258%]). Considering their small surface area and altitudinal amplitude, the littoral (22.7%) and the thermomediterranean (38.8%) belts are also quite species rich in comparison to the supramediterranean belt (46.1%). The cryo-oromediterranean belt is relatively species poor (6.8%) compared to the subalpine belt (12.9%) despite the fact that they occupy, more or less, the same altitudinal range. These results are quite different from those calculated by Gamisans (1991) and cited by Thomson (2005), both in their absolute value than their percentage (e.g. 18% for mesomediterranean floor). This is mainly due to the fact that new data have been added after numerous years of exploration and new publications over the past twenty years.

Globally speaking the vegetation belts result from the effects of the altitude (mainly through temperature variations) on the flora and vegetation, which means, amongst other things, a decrease of species richness with the increase of altitude (corresponding accordingly to a decrease of temperature) (Rahbek, 1995; Körner, 2000). This pattern has already been demonstrated by several studies in the Alpine regions (e.g. Rübel, 1911; Reisigl & Pitschmann, 1958; Grabherr & al., 1995; Theurillat & al., 2003; Aeschimann & al. 2011) and less often in Mediterranean regions (Polunin, 1980). Our results show that the Corsican flora follows the same trends; however, the two lower belts (Li and Tm) are not the richest in terms of number of taxa, which could be due to their very limited size. It must be stressed that the areas covered by each of the vegetation belts are very different, for example the alpine belt occupies 0.36% of the whole island whereas the mesomediterranean belt occupies 71.05% (Jeanmonod & al., 2011a).

Data obtained by Uzunov & Gussev (2003) for the Bulgarian mountains (at a similar latitude to that of Corsica) showed a peak of species richness between 1000 and 1500 m a.s.l. (corresponding, more or less, to the montane belt) and a curve approaching a unimodal function, which is quite different from our results. Similar results as those for Bulgaria have been obtained for the Spanish Pyrenees (Catalonia, Aragon) by Grau & al. (2011) and Villar & al. (2001). It seems likely that the observed decrease of the species richness below 1000 m is driven by factors other than temperature, such as anthropogenic pressure on the flora and vegetation at the lower elevations or water deficit, the latter likely to be particularly important. In fact, it may be responsible for the decrease of the

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Table 1. – Number and proportion of taxa in each vegetation belt, as well as surface area occupied by each of them, and distribution (number and percentage) in the various vegetation belts of the taxa restricted to only one vegetation belt. [Acronyms: Li: littoral; Tm: thermomediterranean; Me: mesomediterranean; Sm: supramediterranean; Mo: montane; Or: cryo-oromediterranean; Sa: subalpine; Al: alpine].

Vegetation belts	Li	Tm	Me	Sm	Mo	Or	Sa	Al
Surface area [km²]	87	175	6215	1034	950	131	122	32
Surface of the whole island [%]	1	2	71.1	11.8	10.9	1.4	1.5	0.4
Number taxa/belt	508	868	1634	1031	715	153	289	137
Total number of taxa [%]	22.7	38.8	73	46.1	32	6.8	12.9	6.1
Taxa exclusive to the belt	139	48	283	47	49	3	16	8
Total number taxa exclusive/belt [%]	27.4	5.5	17.3	4.6	6.6	2	5.5	5.8

species richness observed on Mediterranean mountain summits following the climate change over the last few decades (PAULI & al., 2012).

The species-area relationship, using a logarithmic scale (Fig. 1), shows that the thermomediterranean and the littoral belts have a very high number of taxa (the opposite result to that obtained above with the raw data). Inversely, high mountain belts, especially the cryo-oromediterranean have a rather low number of taxa. The obtained regression line is quite different from the one obtained with different Mediterranean regions (JEANMONOD & al., 2011a) which have a much bigger size. Our result shows a regression line with a slope very close to that obtained by MÉDAIL &VIDAL (1998) for the small islands of south-western France. Our data confirms the decline of the regression line slope for territories with areas smaller than a few thousand square kilometers (MYERS & GILLER, 1988).

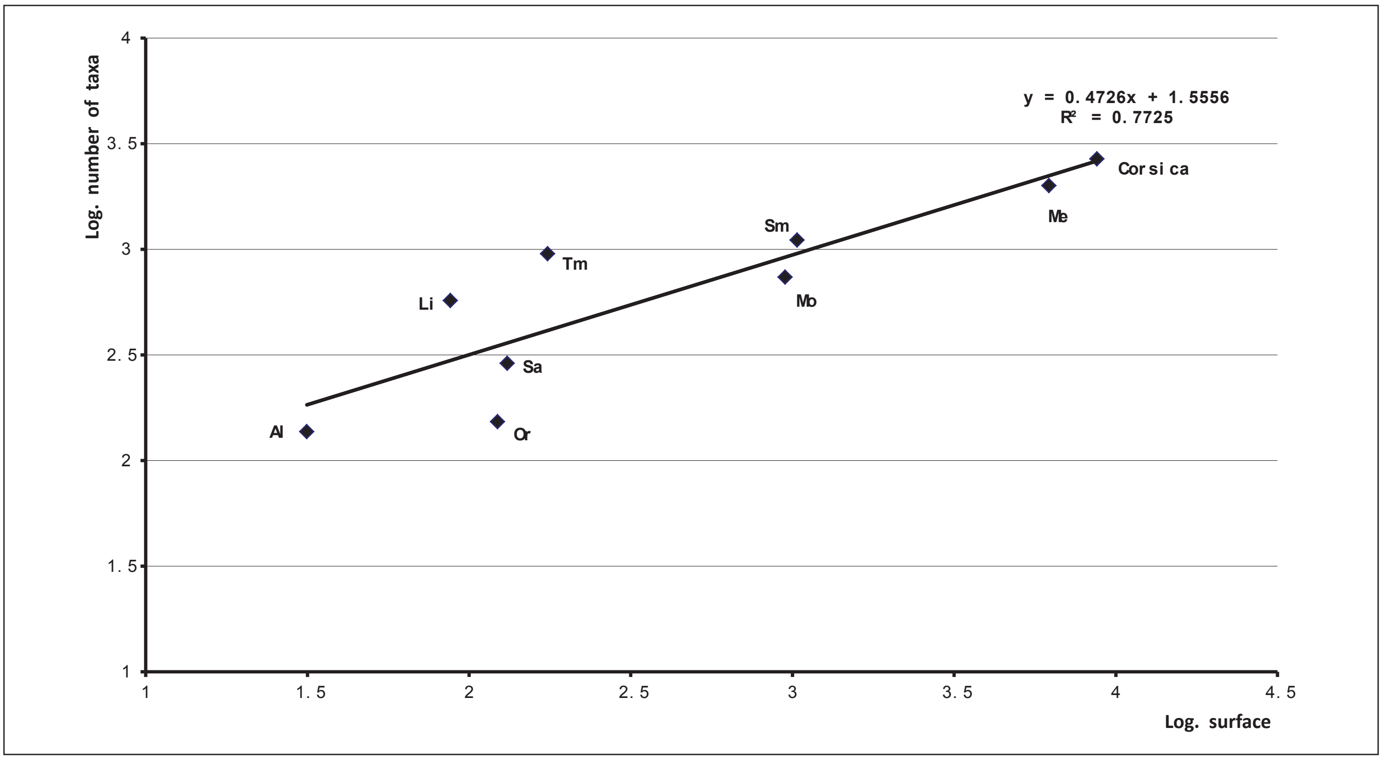

Fig. 1. – Relation (logarithmic mode) between species richness (native taxa) of each vegetation belt and their surface area. [Acronyms: Li: littoral; Tm: thermomediterranean; Me: mesomediterranean; Sm: supramediterranean; Mo: montane; Or: cryo-oromediterranean; Sa: subalpine; Al: alpine; Corsica: whole island].

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Taxonomic distribution (family level)

At the family level, the vegetation belts of Corsica show some specific features. Significant variations in the proportion (percentage of number of taxa) of the 13 most important families on the island in the different belts had already been shown by Jeanmonod & al. (2011a). Figure 2 shows this pattern and highlights a clear difference in the behaviour of the families as a function of altitude (*Lamiaceae* and *Liliaceae* are not shown). It should be noted that the littoral and the cryo-oromediterranean belts do not follow the general trend. As a consequence, the calculation of the r^2 of the regression lines has been made with (first number) and without (second number in square brackets) these two belts. The *Fabaceae* (r^2 = 0.74 [0.95]) and the *Orchidaceae* ($r^2 <$ only 0.21 but [0.78]) show a strong decrease with the increase of altitude. Conversely, the *Rosaceae* (r^2 = 0.61 [0.60]), the *Cyperaceae* (r^2 = 0.14 [0.86]), and to a lesser degree the *Caryophyllaceae* (r^2 = 0.29 [0.70]), the *Ranunculaceae* (r^2 = 0.40 [0.59]) and the *Scrophulariaceae* (r^2 = 0.45 [0.42]) tend to increase in importance with an increase of altitude. These gradients clearly reflect the latitudinal gradients observed between the Mediterranean and the temperate regions (Jeanmonod & al., 2011a). The littoral belt differs strongly from its closest belts (thermo- and mesomediterranean) by a very low proportion of *Fabaceae* and *Lamiaceae* offset by a high proportion of *Caryophyllaceae*, while the cryo-oromediterranean differs from its adjacent belts (subalpine and alpine) by values that appear closer to those of the lower mediterranean belts, in particular with regards to the *Asteraceae* and *Rosaceae*. It also shows a very low proportion of *Orchidaceae* and *Cyperaceae* but an extremely high proportion of *Poaceae* and *Caryophyllaceae*. Finally, there is a remarkable parallelism between the *Poaceae* and the *Caryophyllaceae*, despite the fact that these two families show no, or little, relationship with the altitude. This last result seems to be related to the altitudinal distribution of the different habitats (Fig. 4). Indeed, the curve corresponding to the altitudinal distribution of the rocky habitats is extremely similar to the curves of these two families (Fig. 2). The correlation between the proportion of the *Caryophyllaceae* in each belt and the proportion of rocky habitats in the same belt is statistically significant ($((r_S)0.05(2); 8 = 0.738 < 0.809$; with $0.02 < P < 0.05$). A similar result has been obtained with the *Poaceae* ($((r_s)0.05(2); 8 = 0.738 < 0.857$; with $0.01 < P < 0.02$). These results suggest that the importance of these two families is governed by edaphic rather than climatic factors.

Distribution of life-forms

As shown in figure 3, the therophytes decrease steadily (r^2 = 0.91) from 49.1% to 1.4% with increasing altitude. This decrease has also been shown in the Alps (Aeschimann & al., 2012). The hemicryptophytes show a significant linear increase ($y = 8.4234x + 12.51$ with r^2 = 0.87) with increasing altitude. This pattern has also been observed in the Alps, but in the latter region the increase is even more pronounced among chamaephytes, while in Corsica they show only a slight increase (r^2 = 0.35). In Corsica, the phanerophytes show an increase at first; followed by a decrease, with an optimum at medium altitudes (unimodal distribution), while in the Alps they show a gradual decrease with increasing altitude. The oromediterranean belt stands out clearly from its neighbouring belts by a higher proportion of chamaephytes and a lower proportion of geophytes (no *Orchidaceae*). Finally, we note the relatively high proportion of hydrophytes in the mesomediterranean, which is related to the concentration of the water bodies (lakes, ponds, rivers) in this belt. The comparison with the life-form spectrum from the whole of central Europe (Ellenberg, 1996) reveals that it is the montane belt of Corsica that is closest to the latter in its spectrum, especially in the almost identical proportion of therophytes, but with the proportions of hydrophytes and chamaephytes significantly lower than in temperate areas.

Distribution in the different habitats

The number of taxa in each of the 12 different habitats is very variable. The percentage of taxa linked to these habitats differs according to the vegetation belts (Fig. 4). Three trends are obvious: a) the taxa related to the ruderal and cultivated habitats decrease in proportion with increasing altitude (r^2 = 0.85 and 0.81 respectively); b) Inversely, the plants linked to rocky habitats (r^2 = 0.63) and those growing in the megaphorbs (r^2 = 0.74) tend to increase with increasing altitude. c) for plants related to forests and riparian woods we observe a polynomial curve (r^2 = 0.84 and r^2 = 0.77) with a peak at the montane belt. However, there is a relative homogeneity related to grassland and bushes and plants as those related to wetlands (not shown in the figure data). All the other categories (mainly humid habitats, non indicated in the figure) do not show any linear correlation with the altitude. The littoral belt differs from the others by a predominance of plants related to sandy soils (second after the meadows), and also a relatively low proportion of plants growing in ruderal, cultivated and shrubby habitats. Finally, the cryo-oromediterranean belt stands out due to the high proportion plants that grow in rocky habitats, meadows and shrublands, and relatively low proportion of plants linked to semi-aquatic, humid and riparian habitats.

Abundance

As previously outlined by Jeanmonod & al. (2011a), the taxa that are scarce on the island (D?, RR and R) mainly occupy the mesomediterranean belt (39.6% vs 30.4% of the total flora; $\chi^2 = 134.8$, df = 4, $P < 0.001$), despite the fact that the latter covers a huge area (6215 km^2). This result is similar,

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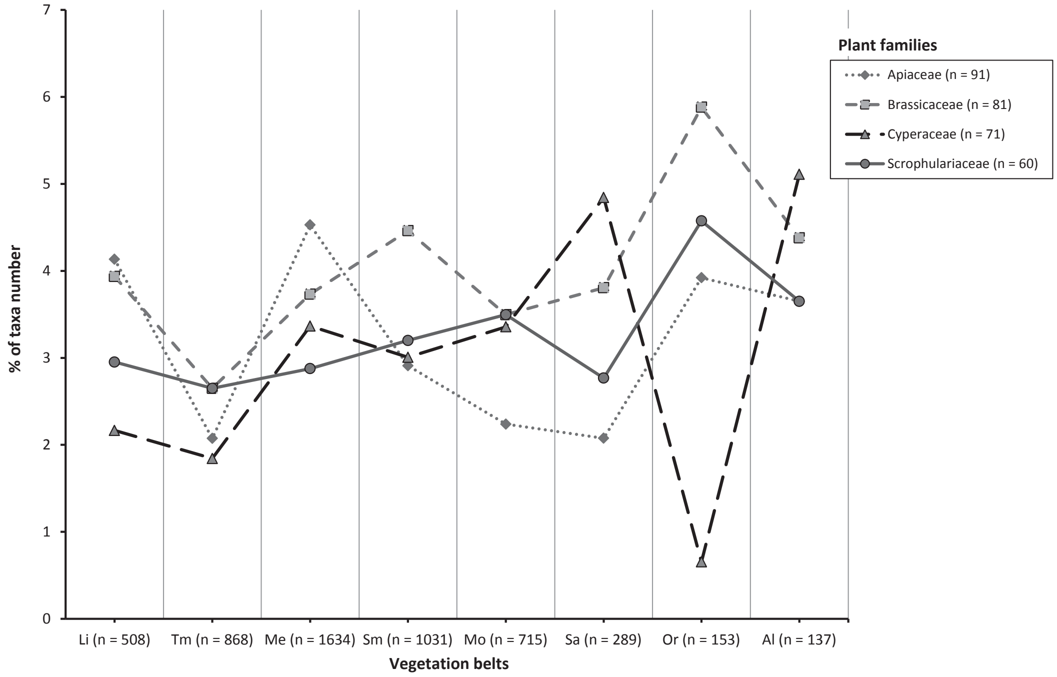

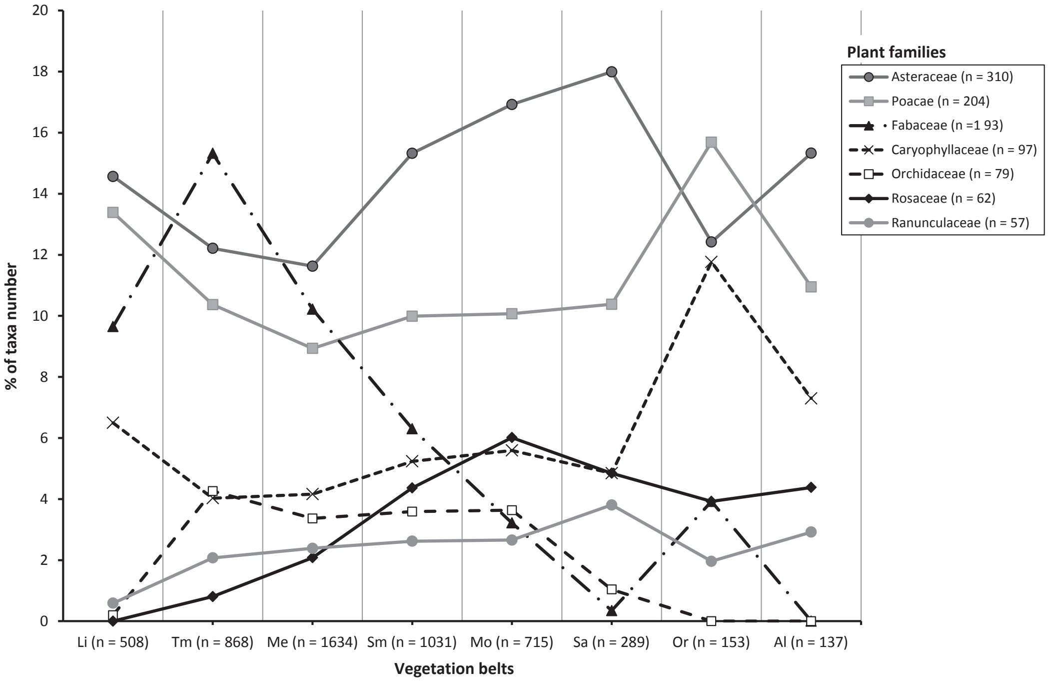

Fig. 2. – Evolution of the species richness (%) of 11 of the 13 most important families in the various vegetation belts. [Acronyms: Li: littoral; Tm: thermomediterranean; Me: mesomediterranean; Sm: supramediterranean; Mo: montane; Or: cryo-oromediterranean; Sa: subalpine ; Al: alpine].

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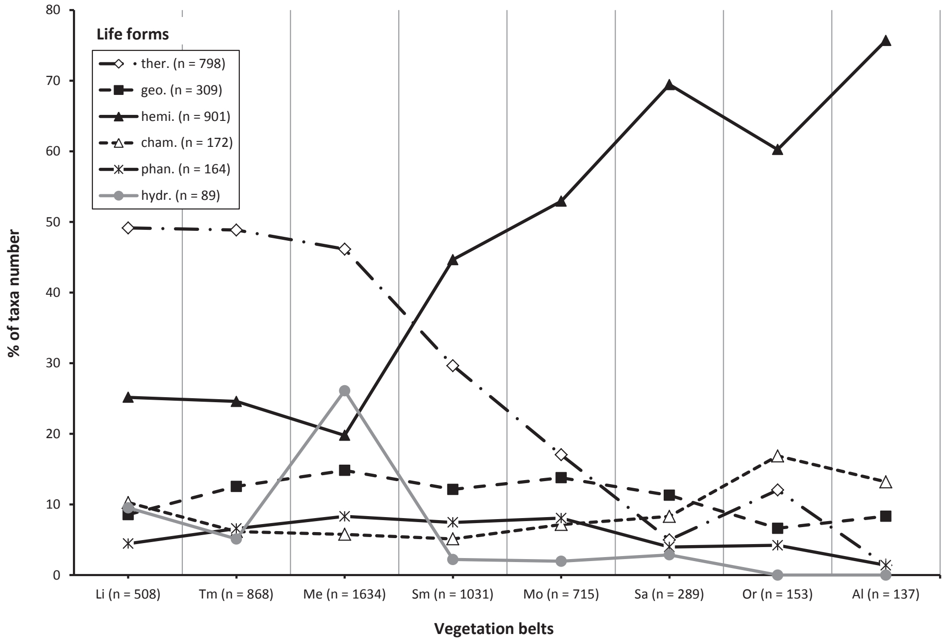

Fig. 3. – Evolution of the proportion (% of number of taxa) of the various life-forms in each vegetation belt (n = total in each class). [Acronyms: Li: ittoral; Tm: thermomediterranean; Me: mesomediterranean; Sm: supramediterranean; Mo: montane; Or: oromediterranean; Sa: subalpine; Al: alpine; phan.: phanerophytes; cham.: chamaephytes; hemi.: hemicryptophytes; geo.: geophytes; ther.: therophytes; hydr.: hydrophytes].

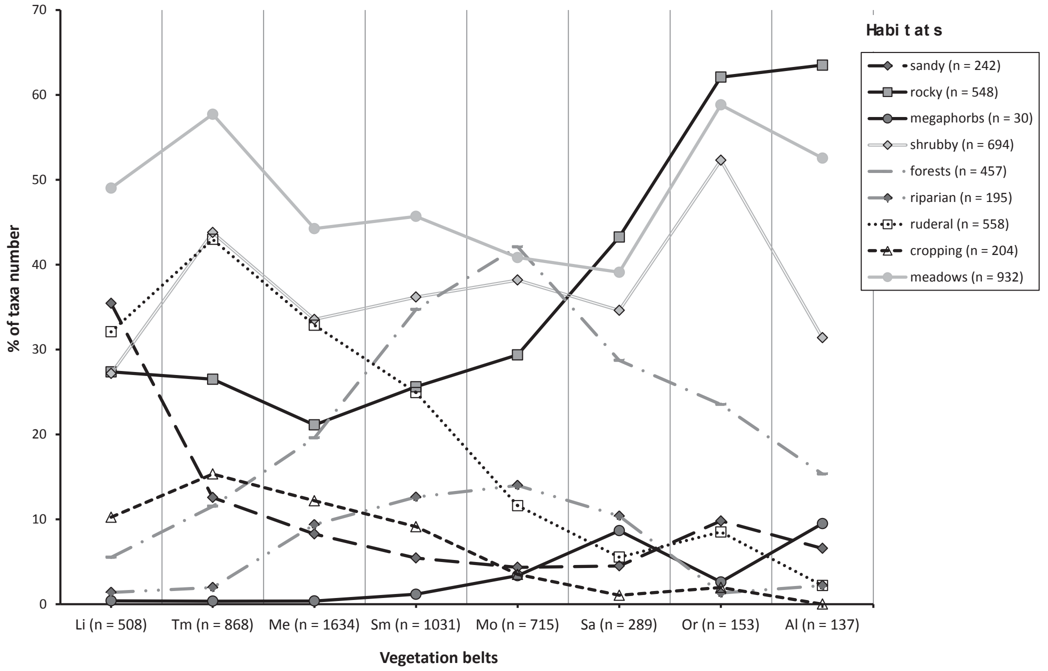

Fig. 4. – Evolution of the proportion (%) of species richness within each habitat in the various vegetation belts (n = total in each class). [Acronyms: Li: littoral; Tm: thermomediterranean; Me: mesomediterranean; Sm: supramediterranean; Mo: montane; Or: cryo-oromediterranean; Sa: subalpine ; Al: alpine].

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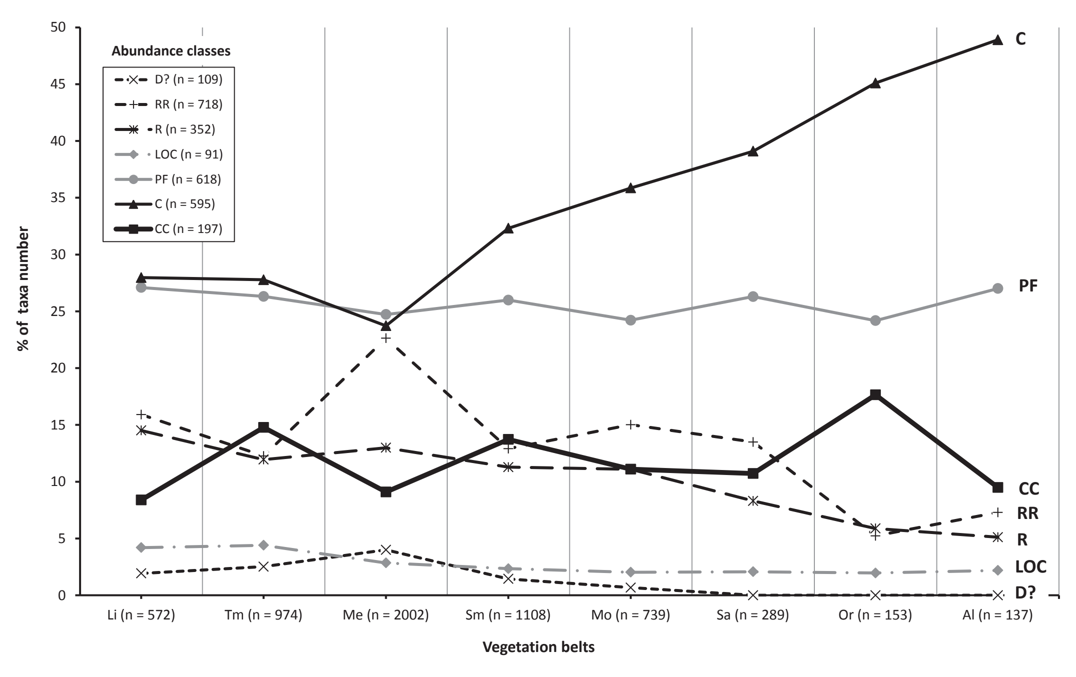

Fig. 5. – Evolution of the proportion (% of whole flora) of each abundance class in the various vegetation belts (n = total in each class). [Acronyms: Li: littoral; Tm: thermo-mediterranean; Me: mesomediterranean; Sm: supramediterranean; Mo: montane; Or: cryo-oromediterranean; Sa: subalpine; Al: alpine; D?: probably extinct; RR: very rare; R: rare; LOC: localised; PF: infrequent; C: common; CC: very common].

but less obvious, when only the native flora is considered (results not shown). Figure 5 indicates that the proportion of the scarce taxa decreases with increasing altitude ($r^2 = 0.91$). In contrast, the proportion of common taxa (C) increases sharply ($r^2 = 0.87$), despite a diminution of the size of the belts above the mesomediterranean belt. The rare and very rare (R and RR), and the common and very common (C and CC) taxa distributions are significantly associated with vegetation belts. (R: $\chi^2 = 21.8$, df = 7, $P = 0.0028$; RR: $\chi^2 = 103.86$, df =7, $P < 0.001$; C: χ^2=107.44, df = 7, $P < 0.001$; CC: $\chi^2 = 39.11$, df = 7, $P < 0.001$). Thus, the high abundance values of the scarce taxa seems to be related to factors acting mainly at the level of the mesomediterranean belt, such as the presence of limestone areas and the effect of strong anthropogenic pressure (see also JEANMONOD & al., 2011a). Once again, the cryo-oromediterranean belt differs from its neighbouring belts, since it has a rather low proportion of R (5.9%) and RR (5.2%) taxa and a very high proportion (45.1%) of C taxa.

Altitudinal amplitude

It is well-known that taxa differ in their respective altitudinal distribution, not only in their optimum but also in their amplitude. Independently of their abundance, some taxa have a very broad altitudinal distribution, expanding over several vegetation belts whereas others have a very narrow one, restricted to only one belt. Taxa in the latter category are extremely useful to floristically characterize the specific belts (GAMISANS, 1991, 2010). The altitudinal amplitude of the whole Corsican flora is given in Figure 6. It shows that the great majority of the taxa are restricted to only one belt whereas remaining taxa are distributed over two or three belts, with an average of 2.22 belts occupied per taxon. The number of taxa able to grow in all the belts is extremely low (6). The curve is quite different if only the indigenous taxa are taken into account. In this case the median is at 3 belts, with an average of 2.39 belts per taxon. Indeed, the introduced taxa (representing 16.5% of the whole Corsican flora) are mainly (61.96%) distributed in only one belt (average 1.40), which is related to the colonisation dynamics of these taxa (see JEANMONOD & al., 2011b). The shape of our curve is very similar to the one obtained by MÉDAIL & VERLAQUE (1997) for south-eastern France (but different from the one they obtained for Corsica on the basis of 400 randomly selected taxa).

The taxa restricted to one vegetation belt (Table 1) are mainly located in the mesomediterranean, which is also the belt that contains the very scarce taxa (RR and R). But

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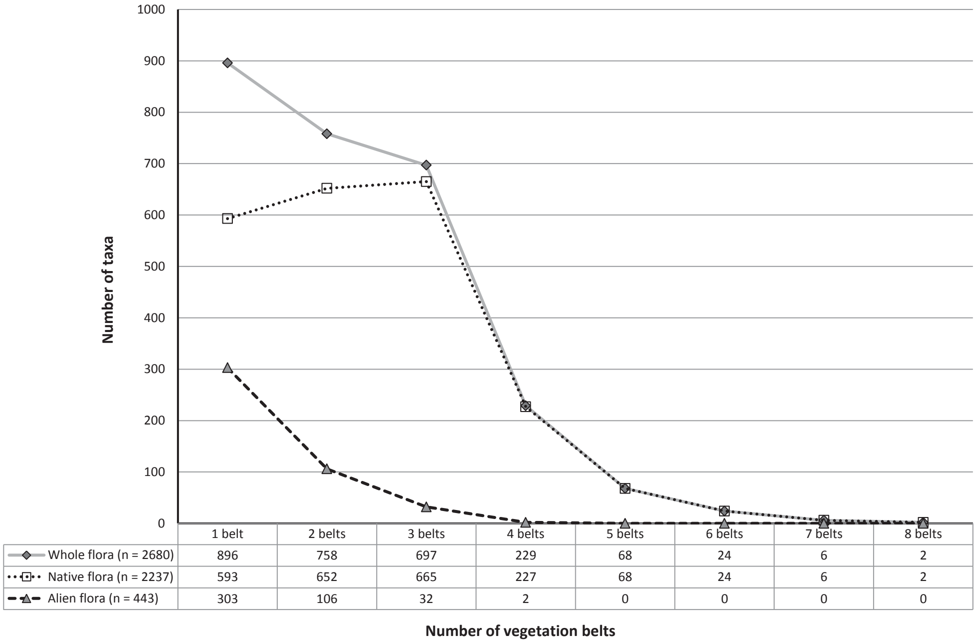

	1 belt	2 belts	3 belts	4 belts	5 belts	6 belts	7 belts	8 belts
Whole flora (n = 2680)	896	758	697	229	68	24	6	2
Native flora (n = 2237)	593	652	665	227	68	24	6	2
Alien flora (n = 443)	303	106	32	2	0	0	0	0

Fig. 6. – Number of taxa that occupy one to eight vegetation belts (n = total in each class).

proportionally, the littoral belt is richer in characteristic taxa (29.2% of the whole flora and 27.4% of the indigenous flora). In contrast the cryo-oromediterranean contains a very low proportion of characteristic taxa (2%). The remaining belts are more or less equivalent with 4.6 to 7.2% of characteristic taxa.

Regarding life-forms, our results reveal that 67.7% of the hydrophytes and 46.3% of the chamaephytes (whole flora) are specific to one belt. This value is only 28.2% for the hemicryptophytes and 29.8% for the therophytes, and it drops respectively to 22.1% and 23.1% of the native flora (without the introduced taxa). There are 100 large amplitude taxa occurring in 5 to 8 belts. All these taxa are indigenous, amongst which 65% are hemicryptophytes, 25% are therophytes, 13% are chamaephytes, 10% are geophytes and the remaining 3% are represented by the phanerophytes. There are no hydrophytes with large altitudinal amplitude.

The analyses of the relation between the abundance of the taxa and the number of occupied belts shows that 78% of the D? taxa and 70.8% of the RR taxa are only distributed in one belt. But this rate drops to 29.8% for the R taxa. Many of the R taxa are present in 4 or 5 belts. This means that the rarity of many taxa is not mainly driven by narrow ecological requirements, but rather by colonisation problems. it should be stressed that among the R and RR taxa that are limited to only one belt, many (28 out of 105, or 27%) are alien taxa and most likely, have not had the time to spread to other belts (see also Jeanmonod & al., 2011b).

2. Habitats

Alpha diversity

Species richness varies greatly depending on habitat (Fig. 7). Meadows are the richest habitat (997 taxa, 37.2% of the whole Corsican flora) followed by the ruderal habitats (859; 32.1%) and the shrubby habitats (727; 27.1%). The species richness of these habitats is correlated with the surface area that these habitats occupy in Corsica ($(r_s)0.05(2)$; $12 = 0.587 < 0.647$; with $0.02 < P < 0.05$), but it probably also reflects to some extent the inherent potential diversity of the different types of habitat. Our results show also that the introduced flora (16.5% of the total flora) occupies mainly the ruderal habitats (35% of this habitat flora) and to a lesser degree the cultivated habitats (27.9% of this habitat flora), and is completely absent from the megaphorbs. If we look at only the indigenous flora, the rate of taxa linked to the meadows and the shrubs is even higher (41.7% respectively 30%).

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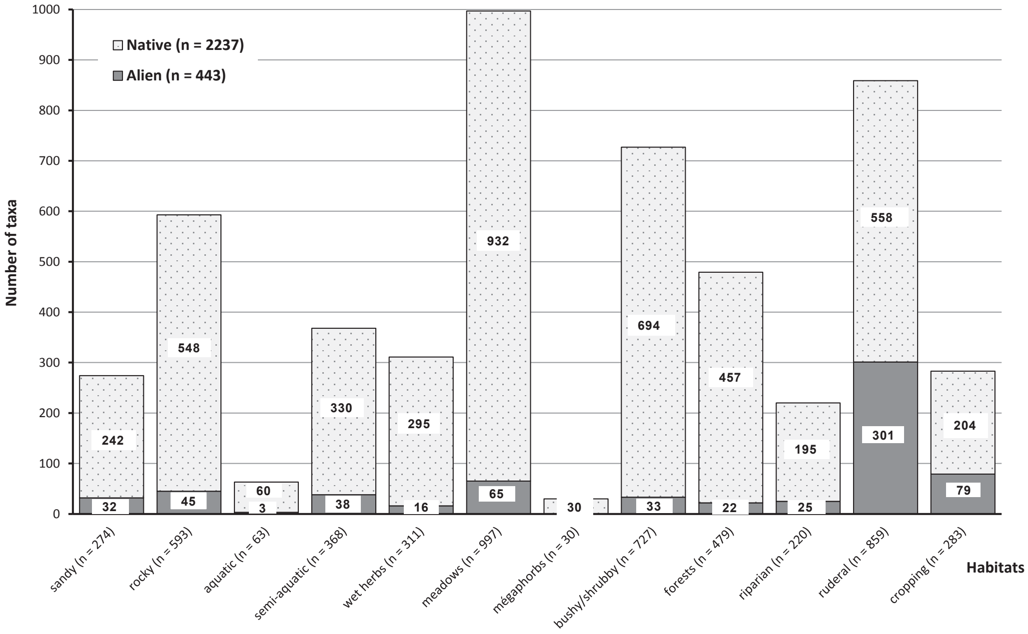

Fig. 7. – Number of taxa growing in each type of habitat (n = total in each class).

Abundance

Jeanmonod, & al. (2011a) have already shown that the RR taxa are very important in the ruderal habitats (23.7% of the flora of this habitat), a result which reflects the high proportion of recently introduced plants in this type of habitat. Another analysis of the proportion (percentage) of the taxa from a given abundance class in each habitat (not shown) shows that the aquatic habitats have a particularly high proportion of RR plants, whereas the megaphorbs show a high proportion of PF plants. The indigenous flora reveals an important proportion of scarce taxa (RR, R and LOC) in the meadows (292 = 13.1%), followed by the shrubby (182 = 8.1%) and the rocky (163 = 7.3%) habitats.

Life-forms

The biological spectrum (life-forms) in the different habitats is very variable (Fig. 8). Unsurprisingly, the percentage of hydrophytes in the aquatic habitats is very high (88.3%) and drops sharply in the semi-aquatic (15.2%) and the humid habitats (4.7%). The therophytes show a high proportion in the cultivated (81.4%) and ruderal habitats (70.1%) and to a lesser degree in the sandy habitats (57%) and the meadows (48.5%). Surprisingly the proportion of phanerophytes is quite low in the forests (18.2%) but higher in the riparian habitats (26.7%). The hemicryptophytes show a high proportion in the megaphorbs and are relatively high in the forests (53%). Finally, the geophytes show a relatively stable distribution with a minimum in the aquatic habitats and a maximum in the megaphorbs.

On Sardinia, Baccheta & al. (2007) found that the proportion of hemicryptophytes for the rocky habitats is similar to the one on Corsica (48.1% versus 46.6%). The percentage of chamaephytes is much higher on Sardinia (35.6% versus 17.2%), but much lower for the therophytes (5.2% versus 31.4%). These discrepancies are probably due to the fact that, for Sardinia, the authors considered only strictly rupicolous taxa.

3. Substrates (bedrock)

Alphadiversity

The distribution of the flora on the different bedrock types shows that the great majority (1906 taxa, 85.2%) of the indigenous flora is found on siliceous soils or is indifferent to the bedrock type. The serpentinites hold only 44 taxa (2%), out of which only 12 are strictly serpentinicolous (*Allium parciflorum* Viv., *Alyssum robertianum* Bernard, Godr. & Gren., *Asplenium adiantum-nigrum* subsp. *corrunense* (H. Christ) Rivas

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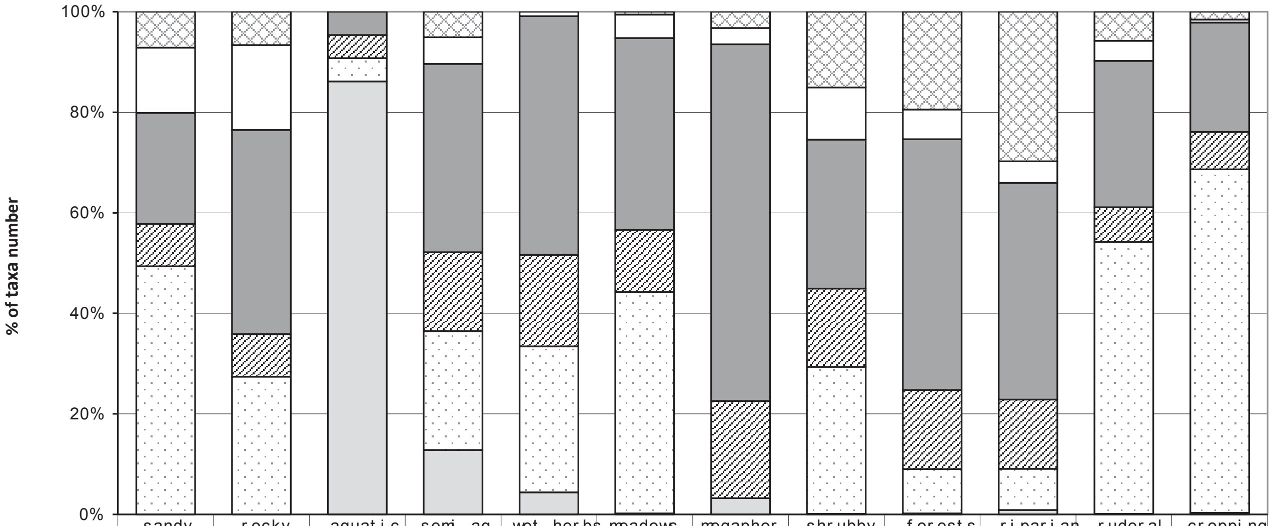

Life-forms	sandy (n=274)	rocky (n=593)	aquatic (n=63)	semi-aq. (n=368)	wet herbs (n=311)	meadows (n=997)	megaphor. (n=30)	shrubby (n=727)	forests (n=479)	riparian (n=220)	ruderal (n=859)	cropping (n=283)
⊠ phan. (n=272)	8.0	7.3	0.0	5.7	0.0	0.6	3.3	16.4	20.7	31.4	6.5	1.8
☐ cham (n=218)	14.6	18.5	0.0	6.0	1.0	5.1	3.3	11.3	6.3	4.5	4.5	0.7
■ hemi. (n=1023)	24.8	44.5	4.8	42.1	52.1	41.6	73.3	32.2	53.0	45.5	32.8	24.7
▨ geo. (n=353)	9.5	9.3	4.8	17.7	19.9	13.4	20.0	16.9	16.7	14.5	7.8	8.5
⬚ ther. (n=960)	55.5	30.0	4.8	26.6	31.8	48.0	0.0	31.8	9.4	8.6	61.0	77.7
▢ hydr. (n=96)	0.0	0.0	88.9	14.4	4.8	0.2	3.3	0.1	0.2	0.9	0.1	0.4

Habitats

Fig. 8. – Biological spectrum (% of the native flora) of each type of habitat (n = total in each class). [Acronyms: phan.: phanerophytes; cham.: chamaephytes; hemi.: hemicryptophytes; geo.: geophytes; ther.: therophytes; hydr.: hydrophytes].

Mart., *A. viride* Huds., *Biscutella rotgesii* Foucaud, *Cardamine plumieri* Vill., *Linaria micrantha* (Cav.) Hoffmanns. & Link, *Notholaena marantae* (L.) Desv. subsp. *marantae*, *Senecio serpentinicola* Jeanm., *Silene armeria* L., *S. inaperta* L. and *S. paradoxa* L.). The schistes hold 56 indigenous taxa (2.5%), with only 11 taxa that are specific to this substratum (*Anarrhinum corsicum* Jord. & Fourr., *Anthericum liliago* L., *Asphodelus macrocarpus* Parl. subsp. *macrocarpus*, *Cardamine chelidonia* L., *Digitalis lutea* subsp. *australis* (Ten.) Arcang., *Gagea bohemica* subsp. *corsica* (Jord. & Fourr.) Gamisans, *G. granatellii* (Parl.) Parl., *G. villosa* (M. Bieb.) Sweet, *Merendera filifolia* Cambess., *Odontites vernus* subsp. *serotinus* Corb. and *Ophrys eleonorae* Devillers-Tersch. & Devillers). The calcareous rock types show the most specific flora with 316 indigenous taxa (13.7%), among which 212 are strictly calcicolous, despite the extremely limited area. A total of 22 taxa are specific to both serpentinites and limestone.

The number of strictly or strongly preferential serpentinicolous taxa for different European regions are given in Table 2. The Spearman's Rank test has shown that there is a linear correlation between the species richness and the size of the different serpentinite areas ((r_S)0.05(2); 14 = 0.538 < 0.616; with $0.02 < P < 0.05$). Corsica is remarkable as it has a very rich serpentinicolous flora (12 taxa, out of which three are endemic

Table 2. – Number of strictly or strongly preferential serpentinicolous taxa in the various geographic regions, and their rank in terms of number of taxa, of size of the given serpentinite zones (increasing order), as well as of their latitudinal (from Nord (1st rank) to South (14th rank)) and longitudinal (from West (1st) to East (14th)) position of their respectif barycenter.

Geographic region	Taxa (number)	Taxa (rank)	Size (rank)	Latitude (rank)	Longitude (rank)
Galicia (ESP)	7	4	2	8	1
Bragança (PRT)	10	6	6	11	2
Andalousia (ESP)	36	12	7	14	3
Massif central (FRA)	2	1.5	1	2	4
Western Alps	2	1.5	10	3	5
Corsica (FRA)	12	7	4	10	6
Northern Apennins (ESP)	22	10	12	5	7
Toscany (ITA)	33	11	8	6	8
Eastern Alps	5	3	3	1	9
Bosnia (BIH)	20	8	11	4	10
Albania (ALB)	45	13	14	12	11
Kosovo (SRB)	9	5	5	9	12
Serbia (SRB)	21	9	13	7	13
Greece (GRC)	81	14	9	13	14

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Table 3. – Most important (highest species richness) plant families of the various serpentinites areas (geographic regions with at least ten strictly or strongly preferential serpentinicolous taxa). [Acronyms: Ave.: average corresponding to the mean number of taxa of each family in each geographic region].

Geographic region	**Bragança**	**Andalousia**	**Corsica**	**Toscany**	**Bosnia**	**Albania**	**Serbia**	**Greece**	**Ave.**
Familly									
Caryophyllaceae	1	5	3	3	3	5	6	13	4.88
Brassicaceae	2	5	3	2	1	8	5	12	4.75
Asteraceae	1	5	1	4	1	4	4	11	3.88
Scrophulariaceae	0	6	1	0	3	3	4	0	2.13
Boraginaceae	0	2	0	1	2	2	2	7	2.00
Lamiaceae	0	1	0	3	3	1	3	5	2.00
Fabaceae	1	5	0	2	1	1	2	2	1.75
Poaceae	1	1	0	5	1	1	2	3	1.75
Rosaceae	0	0	0	0	3	3	5	2	1.63
Apiaceae	1	1	0	0	0	2	2	5	1.38

to Corsica and one is endemic to both Corsica and Sardinia). This is higher than expected (7th rank), especially with regards to the small size of its serpentinite areas (4th rank).

No correlation (Spearman's Rank test) between the species richness and the longitudinal position of the different serpentinites zones was found (($(r_s)0.05(2)$; $14 = 0.538 > 0.445$, with $0.1 < P < 0.2$). This suggests that the increase in the continentality index as one moves from West to East, has poor influence on the species richness. By cons, species richness is correlated with the latitudinal position of these areas (($(r_s)0.05(2)$; $14 = 0.538 < 0.674$, with $0.01 < P < 0.02$), with the northernmost regions possessing a poor serpentinicolous flora, while the southern areas show a high species richness. This result is in agreement with that obtained by Stevanovi & al., (2003) in the Balkan region, but unlike our work, these authors concluded that the species richness of the serpentinite areas was not correlated with the size of the latter.The comparison of these results with those originating from regions situated at a similar latitude as Corsica are as follows: in Tuscany (ITA) Chiarucci (2004), Chiarucci & Dominicis (2001) and Selvi (2007) estimate the serpentinicolous flora to be 809 taxa, out of which 33 (4.3%) are strictly and 24 (3%) are preferentially serpentinicolous taxa; for Serbia Stevanovi & al. (2003) and Vasi & Dikli (2001) list 300 taxa growing on this substratum, but only 21 (7%) are considered to be strictly serpentinicolous taxa; while 45 strictly serpentinicolous taxa are listed for Albania (Brooks, 1987; Stevanovi & al., 2003). In Portugal, Aguiar Gonçalvez & al. (1998), Menezes de Sequeira & Pinto da Silva (1992) and Pinto da Silva (1965, 1970, 1981) list 409 taxa developing on ultramafic outcrops (28.7% of the flora of the Bragança region), out of which 10 (2%) are strictly serpentinicolous taxa and 42 (10.3%) are preferential taxa. The ten most commonly encountered plant families in these regions (with more than 10 strictly serpentinicolous taxa) are given in Table 3.

Thus, we see that the families containing the highest number of strictly serpentinicolous taxa are the *Brassicaceae, Caryophyllaceae* and *Asteraceae*. These three families are present in all the analyzed regions. By cons, the *Rosaceae* are only present in the East (Balkan regions), a tendency shared with the *Boraginaceae* and *Lamiaceae* (few taxa in the West, many taxa in the East). Inversely, the *Fabaceae* are mainly present in the West (Iberian Peninsula).

Life-forms

The relation between the flora of a given substratum and the life-forms shows great differences in the obtained spectrum for each substratum as well as for the one obtained for the total flora (Fig. 9). Comparatively, chamaephytes are well established on the serpentinites (22.7%), whereas the therophytes show a high proportion on limestone (39.9%) and the geophytes a very high proportion on the schistes (34.5%). These results are quite different from those given by Floret & al. (1990) and Verlaque & al. (2001) for the Mediterranean region, where therophytes and geophytes are more numerous on siliceous soils than on limestone. However, they corroborate the importance of the chamaephytes on limestone (13.9%) and serpentinites (17.2%) compared to their proportion on siliceous bedrock (4.1%). In fact, the Corsican hemicryptophytes are the group of plants showing the greatest difference between calcareous (28.2%) and siliceous soils (41.3%).

Regarding the serpentinites, these figures are also a bit different from those published by Chiarucci & Dominicis (2001) for Tuscany (ITA), where the chamaephytes show a proportion of only 7.4%. However, the proportion of hemicryptophytes (40%) and therophytes (27.4%) is prevalent and close to the proportions found on Corsica (40.9%). Similarly, in the Rhodopes of south-west Bulgaria, Pavlova (2010) found only 4% of chamaephytes, but 53.7% of hemicryptophytes and

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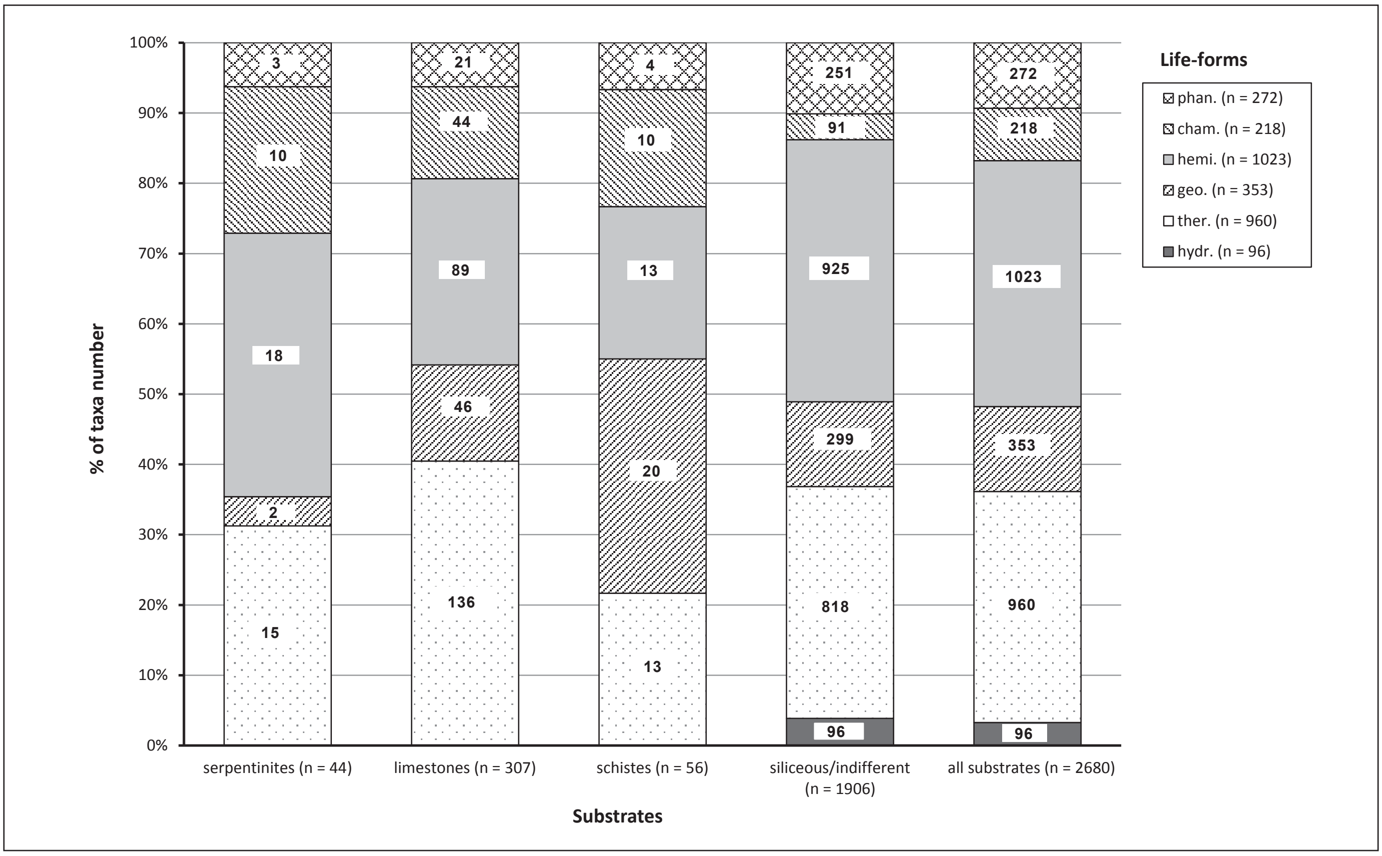

Fig. 9. – Biological spectrum of the native plants growing on each of the various substrates (percent of the number of taxa ; n = total in each class). [Acronyms : phan : phanerophytes ; cham : chamaephytes ; hemi : hemicryptophytes ; geo : geophytes ; ther : therophytes ; hydr : hydrophytes].

27.4% of therophytes. Globally speaking, the results of Ferrari & al. (1991) for the Northern Apennines (Emilia-Romagna, Liguria, Lombardia, Piemonte ; ITA), with a more temperate climate than in Tuscany, are very similar of those of Chiarucci & Dominicis (2001). Nevertheless, they show great variations among their twelve study sites. Indeed, only the hemicryptophytes are consistently dominant (> 40%) and the geophytes are found to be present in low proportion (< 11%). The observed variations seem to indicate that the local characteristics (i.e. altitude, exposure, fire frequency etc.) have a significant impact. Finally, the very low proportions of geophytes on the Corsican ultramafic soils is obvious and confirms the results obtained by many studies on this type of substratum (Brooks, 1987).

Abundance

Considerable heterogeneity has been found in the abundance of the taxa growing on specific substrates (Fig. 10). The calcareous soils contain many taxa with a restricted distribution across the whole island (45.9% of the taxa belong the abundance classes RR, R or LOC, plus 2.3% of the taxa in the D? class). These abundance rates are much lower on serpentinites (25%) and to a lesser degree on schistes (33.9%) and siliceous soils (35.2%). These results indicate clearly that the proportion of restricted range taxa is independent of the surface of the substratum type. The serpentinite areas, with their very low surface area, have very low species richness which likely reduces the interspecific competition. As a result, the taxa colonising this type of substratum seem to be able to spread quite efficiently. Inversely, the limestone areas, with a similar scattered and low distribution, show a very high species richness, inducing a strong interspecific competition. As a consequence, the taxa have more problems to spread and thus, many of them remain restricted to a few localities.

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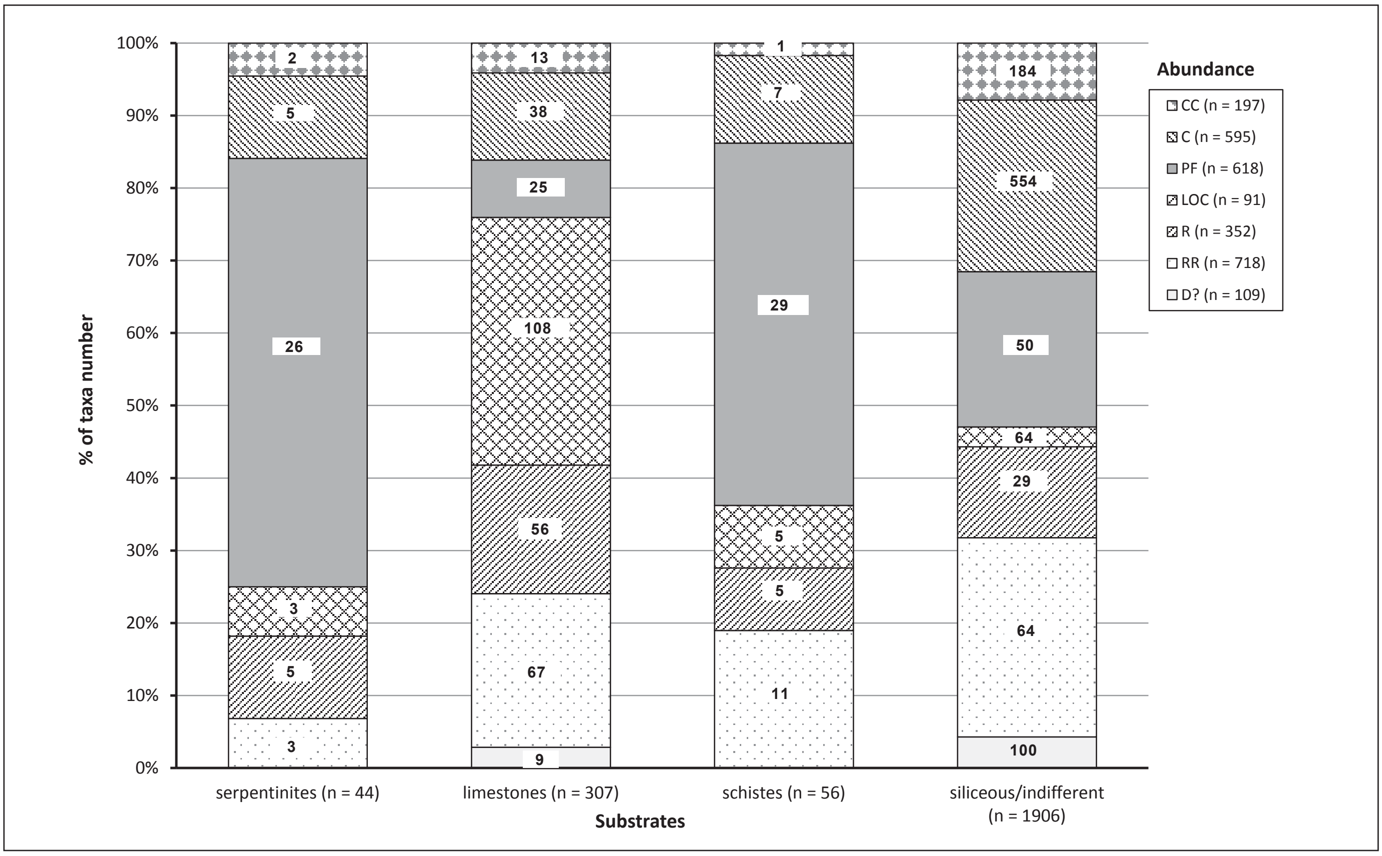

Fig. 10. – Species richness (in percentage) of the various abundance classes on each of the various substrates (n = total in each class). [Acronyms: CC: very common; C: common; PF: infrequent; LOC: localised; R: rare; RR: very rare; D?: probably extinct in Corsica].

Conclusions

Our results show a strong compartmentalization of the island's flora. This is firstly highlighted at the level of the vegetation belts.

Addressing the issues proposed in the introduction, our analyses show that:

1. The alphabiodiversity values of the vegetation belts are quite different of those calculated by the time by Gamisans (1991) and cited by Thomson (2005), both in their absolute values, and their percentage values (eg 18% for the mesomediterranean belt). However, the observed pattern seems mainly driven by area occupied by the various vegetation belts. Thus, the mesomediterranean belt has the highest species richness because it occupies the greatest area. But according to the Arrhenius law, this vegetation belt is not richer than the montane, subalpine and alpine belts. On the other hand, the littoral and the thermomediterranean show a much greater species richness than expected, whereas the cryo-oromediterranean belt is extremely poor in species.

Moreover, within the island, the various vegetation belts show strong differences in their taxonomic composition as well as in their biological spectrum. Although some of the findings where highlighted by Jeanmonod & al. (2011a), such as the decrease of the *Fabaceae* and the increase of the *Rosaceae, Cyperaceae* and *Ranunculaceae* with increasing altitude, or the decrease of the therophytes and the increase of the hemicryptophytes with increasing altitude, others are quite unexpected. These include the high proportion of *Poaceae* and chamaephytes in the cryo-oromediterranean belt, and the specificity of the littoral belt which shows a particularly high rate of *Caryophyllaceae* and chamaephytes and a low rate of geophytes. The importance (proportion of species richness) of the *Poaceae* and *Caryophyllaceae* is correlated to the distribution of the rocky habitats (edaphic factors) rather than with the altitude (climatic factors). Furthermore, our analyses stress the peculiarity of the cryo-oromediterranean belt in comparison to its adjacent belts, in particular to the subalpine belt that is situated at an equivalent altitude.

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2. If the characterization of the vegetation belts by the presence of specific habitats is well-known (Emberger, 1930; Ozenda, 1975, 1985; Rivas-Martinez, 1981; Peinado Lorca & Rivas-Martinez, 1987; Gamisans, 1991, 2010; Reisigl & Keller, 1994; Theurillat & al., 1994; Blasi, 2010; Klötzli & al., 2010), the abundance of the taxa growing in these belts remains poorly studied. We found that the gradient of the abundance rate goes in the opposite direction to that expected. Indeed, if we consider that the surface decreases sharply from the mesomediterranean belt to the alpine belt, and that the fragmentation of habitats increases, one would expect to find a higher proportion of restricted range taxa in the upper altitudinal belts. Our results show that, on Corsica, it is exactly the opposite. Rare taxa (RR and R) are proportionally fewer in higher altitude belts than in the mesomediterranean belt and it is exactly the opposite for common taxa. The occupied area and the climatic conditions do not seem to play an important role in the frequency pattern. The explanation seems rather to be the greater presence of very specific habitats in the mesomediterranean belt or the greater human pressure. Whether this pattern is characteristic of any mountain massif, or any type of Mediterranean island, or rather a peculiarity of Corsica, is unknown to us due to the lack of comparable data from other territories.
3. Concerning the life forms in the various vegetation belts, we observe a pattern similar to that observed in the Alps but with two aspects that seem specific to the Mediterranean: a lower proportion of hydrophytes and chamaephytes.
4. The distribution pattern of the habitats in the vegetation belts is much less pronounced than expected. If the proportion of forest plants is actually higher in the supramediterranean and mountain belts, bushes and shrubs do not dominate the expected belts (thermo- and mesomediterranean belts) but only in the cryo-oromediterranean belt. This belt is also the one that stands out most of the other surrounding belts. Three trends are evident: a) a decrease with altitude of the ruderal plants and those in cultivated habitats, b) an increase with altitude of plants related to rocky habitats and megaphorbs c) an unimodal curve with a peak at the montane with plants related to forests and riparian woods. However there is a relative homogeneity related to grasslands, bushes and shrubs habitats and plants related to wetlands.

Concerning the habitats, the analyses emphasize the differences between the native and the alien flora, the latter being mainly associated with ruderal and cultivated habitats. They also tell us that, concerning the native flora, it is those taxa that inhabit the meadows, shrubby and rocky habitats that have the highest number of taxa with restricted distributions (very rare to localised taxa). This result should promote protection measures that are specifically directed towards these environments. Over recent years, in the Mediterranean regions and particularly on Corsica, there has been a tendency to remove the woody vegetation along the ridges in order to limit the spread of fires (fire break bands). This procedure could threat some very rare taxa or, to the contrary, promote the spreading of some of these taxa by preventing the overgrowth of woody vegetation and closure of habitats (Hadar & al., 1999; Etienne, 2001). Targeted studies on taxa with restricted distribution and/or endemic taxa should be conducted on Corsica in order to assess the impact of such practices.

The analyses of the flora from the various substrates show a strong heterogeneity. However, there is no relationship between the surface of these substrates and their alpha diversity. The schistes, which occupy a large area, do not show an important specific flora, unlike that on limestone, despite the very small and scattered distribution of the latter. The calcareous soils harbour plants that are mainly related to the meadows and ruderal habitats, and the predominant life-form is the therophytes. The serpentinites which have a small but dispersed coverage on the island, show not only a low species richness, but also a low proportion of restricted range taxa. The latter could be due to reduced interspecific competition (low species richness and low plant density) favouring the spatial development of the taxa growing on this type of substrate. The fact is that given its insularity, its latitudinal position and its low extension of the ultramafic areas, Corsica is characterized by a particularly rich strictly serpentinicolous flora (12 taxa), when compared with other similar areas. This result is consistent with the high species richness of the whole native flora of Corsica compared to that of other Mediterranean islands (Jeanmonod & al., 2011a).

The results from our analyses highlight a number of interesting features about the flora of Corsica. Unfortunately, in many cases comparisons with other territories are difficult (heterogeneity of data, data not synthesized), or even impossible (data unpublished) thus is it difficult to conclude whether a given result corresponds to a general trend or is a peculiarity of the Corsican flora. We hope that this article will encourage botanists to publish data from their regions in order to answer in the future many of these questions.

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