



Red Listing plants under full national responsibility: Extinction risk and threats in the vascular flora endemic to Italy

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ABSTRACT

Taxa endemic to a country are key elements for setting national conservation priorities and for driving conservation strategies, since their persistence is entirely dependent on national policy. We applied the IUCN Red List categories to all Italian endemic vascular plants (1340 taxa) to assess their current risk of extinction and to highlight their major threats. Our results revealed that six taxa are already extinct and that 22.4% (300 taxa) are threatened with extinction, while 18.4% (247; especially belonging to apomictic groups) have been categorized as Data Deficient. Italian endemic vascular plants are primarily threatened by natural habitat modification due to agriculture, residential and tourism development. Taxa occurring in coastal areas and lowlands, where anthropogenic impacts and habitat destruction are concentrated, display the greatest population decline and extinction. The national network of protected areas could be considered effective in protecting endemic-rich areas

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(ERAs) and endemic taxa, but ineffective in protecting narrow endemic-rich areas (NERAs), accordingly changes to the existing network may increase the effectiveness of protection. For the first time in the Mediterranean Basin biodiversity hotspot, we present a comprehensive extinction assessment for endemic plants under the full responsibility of a single country. This would provide an important step towards the prioritization and conservation of threatened endemic flora at Italian, European, and Mediterranean level. A successful conservation strategy of the Italian endemic vascular flora should implement the protected area system, solve some taxonomical criticism in poorly known genera, and should rely on monitoring threatened species, and on developing species-specific action plans.

1. Introduction

Due to their restricted distribution, endemic taxa (i.e. showing a natural range restricted to a well-defined area, Anderson, 1994; Casagrande and Lizarralde de Grosso, 2013) may be intrinsically threatened (Ellstrand and Elam, 1993; İşik, 2011), and are therefore highly important in the global, national, and local (regional) prioritization of conservation efforts (Das et al., 2006; Huang et al., 2016). Indeed, the decline of plant species and populations may induce the extinction of endemic taxa, causing a loss of unique evolutionary history and ecosystem services (Isaac et al., 2007). Several international initiatives are in place to reduce the loss of biodiversity, including international treaties (i.e. Convention on Biological Diversity's 2020 target) and conservation policies (i.e. Directive 1992/43/EEC in Europe). Nevertheless, a national approach to biodiversity protection is the most effective way for a country to protect its endemic flora, since “it is at regional and local scales that human actions and biodiversity collide” (Pimm et al., 2001). The choice in applying the concept of endemism to artificial borders like national boundaries has some limitations. Species endemic to a country tend by definition to be placed away from countries' boundaries, while taxa of conservation interest for a certain biogeographic region falling between the boundaries among two or more countries will remain excluded. However, this political scale has also an immediate practical reflection, given that most conservation decisions and policies have to be met at national level and, consequently, the global chance of survival for species endemic to a country is entirely dependent on its national policy. Thus, endemic taxa are key elements for setting national conservation priorities and for assigning conservation tasks (Schmeller et al., 2008; Brundu et al., 2017). In general, the higher the number of taxa endemic to a country, the greater the responsibility of that country in preserving global biodiversity. However, in megadiverse countries (e.g., Brazil or Mexico; Canhos et al., 2015; Sarukhán et al., 2015) the high number of endemic species may require a prioritization of conservation efforts.

This also can be applied to Italy, a country placed in the heart of the Mediterranean Basin, a region considered one of the most threatened global biodiversity hotspots, due to the high rate of endemism and to the high human impact (Vogiatzakis et al., 2006; Cuttelod et al., 2008; Médail, 2017). This “political” choice shows in Italy less shortcomings compared to other countries, given that the geographical position of the Italian peninsula and the limited area (i.e. Alps) shared with neighbouring countries. In Italy, according to the most recent checklist, the native vascular flora consists of 8195 taxa, 1707 of which are endemic to Italy, Italy and Corsica (France), or Italy and Malta (Bartolucci et al., 2018). Among these taxa, 1340 (16.4%) are narrow endemics confined to Italy (subspecies of *Hieracium* and *Pilosella* excluded, see also Peruzzi et al., 2014, 2015, continuously updated online). These include four endemic genera: *Eokochia* (Amaranthaceae), *Rhizobotrya* (Brassicaceae), *Petagnaea* and *Siculosciadium* (Apiaceae). Considering the high number of endemic species occurring in Italy, and in other countries within biodiversity hotspots, it is urgent to focus on conservation priorities, at global, national, and regional level, as well as on stimulating conservation actions and raising public awareness.

The recent State of the World's Plants report from the Royal Botanic Gardens of Kew estimates that 50,000 of the ~390,000 globally known

vascular plant species are threatened with extinction (Royal Botanic Gardens, 2016). According to the Global Strategy for Plant Conservation 2011–2020 of the Convention on Biological Diversity (CBD; Objective I, target II; GSPC; <https://www.cdb.int/gspc/>), one of the key stages is the preliminary assessment of the conservation status of the whole Earth's flora. A reliable evaluation of the conservation patterns of plant species represents an important step not only to evaluate progress towards the CBD's Aichi Targets of the Strategic Plan for Biodiversity 2011–2020 (Pimm et al., 2014), but also to identify effective conservation strategies (Collen et al., 2016). However, the proportion of assessed plant species is still low compared, for instance, to vertebrates (Collen et al., 2016). IUCN Red Listing is widely used to evaluate the global conservation status of species and to estimate their extinction risk (e.g., Mace et al., 2008; Maes et al., 2015). Hence, up-to-date Red Lists are important starting points for conservation actions and provide useful information for monitoring changes in the conservation status of species (e.g., Red List Index; Bubb et al., 2009). Nowadays, the publication of new plant species frequently includes an assessment of their status based on the IUCN criteria. Although some Italian endemic taxa have been recently assessed against the IUCN criteria (e.g., Foggi et al., 2014; Rossi et al., 2016; Orsenigo et al., 2016, 2017; Fenu et al., 2016, 2017a), a comprehensive Red List for the Italian endemic vascular plants is still lacking. The evaluation of the extinction risk of all the Italian endemic plants would provide a powerful tool for driving further conservation steps for these unique organisms. For example, stimulating the improvement of the national network of protected areas, the implementation of a national legislation for the protection of the flora, and the reinforcement of the most threatened species.

In this paper, we present a complete and updated risk assessment of all Italian endemic vascular plants (1340 taxa), using the current IUCN Red List categories and criteria (IUCN, 2012a). This work is based on an exhaustive database, including information from herbarium specimens, literature and field surveys performed in the last fifteen years. With this assessment, we aimed to identify the most threatened endemic plant taxa (and genera) and to highlight those taxa requiring urgent conservation actions, helping to set conservation priorities at national and European level. In particular, our red listing aimed to answer the following questions: 1) what is the current extinction risk of the Italian endemic vascular plants? 2) what are the major threats to Italian endemic plants? 3) does the Italian system of protected areas ensure an adequate protection to endemic vascular plants and endemic-rich areas? This work provides the first comprehensive assessment of the endemic plants for a country in the Mediterranean Basin biodiversity hotspot. Considering that Italian endemic flora significantly contributes to the outstanding biodiversity of the Mediterranean region, our work may provide new and useful information on the general conservation status of the flora of this biodiversity hotspot.

2. Materials and methods

2.1. Endemic species checklist

In the present study, Italian endemic plants are defined as taxa whose distribution is strictly limited to the Italian administrative territory, excluding all vascular plants occurring also in neighbouring

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