

Seed Conservation of the Endemic and Threatened Plants of Crete



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Summary

One of the key parameters in the sustainable use and management of natural resources is the study, documentation and conservation of plant diversity. The aim of this project is the *ex situ* conservation of the endemic and threatened plants of Crete. A seed bank has been established in the campus of the Mediterranean Agronomic Institute of Chania, Crete (MAICh). Data from the germination tests conducted for the species and additional data relating to the geographic distribution, biological and ecological characteristics, conservation status and threats of the target taxa are maintained in an electronic database. These data are utilized in GIS applications and are useful as basic information in the elaboration and implementation of management plans related to natural resources in Crete.

Introduction

The study, documentation and conservation of biodiversity, and especially of the threatened and endemic flora of an area are an important priority for the sustainable management and use of natural genetic resources.

The aim of this particular project is the protection of the endemic and threatened plants of Crete, directly through the establishment of a seed bank and the collection and storage of genetic material, namely seeds (*ex situ* conservation), and indirectly, through the documentation of information concerning the geographic distribution, biology, habitats and population size of target plants and the threats to them.

This project is the first of its kind for the area of Crete, which is the largest island in Greece and the fifth largest in the Mediterranean region, with a land area covering about 8,700 km². The island is located in the Southern Aegean sea, roughly equidistant from Europe, Asia and Africa.

Materials and Methods

The target native taxa (species and subspecies) of this study were 184 endemic plants of Crete, 47 of which are included in the Red Data Book of Rare and Threatened Plants of Greece (Phitos *et al.*, 1995), and 14 non-endemic plants, which are also included in the Red Data Book of Greece, amounting to a total of 198 taxa. Recent publications were used for the selection of the target taxa and for the nomenclature that was followed (Turland *et al.*, 1993; Jahn and Schönfelder, 1995; Montmollin and Iatrou, 1995; Phitos *et al.*, 1995; Chilton and Turland, 1997; Strid and Tan, 1997; Kypriotakiand and Artelari, 1998; Tzanoudakis and Kypriotakis, 1998; Kypriotakis and Tzanoudakis, 1999). The seed bank was established at MAICh according to the recommendations of Cromarty *et al.* (1990). For the collection of the seeds, as well as for further processing and manipulation (drying, cleaning, storage and general management of the seed lots), international standards and recommendations were followed (Ellis *et al.*, 1985; FAO/IPGRI, 1994; Guarino *et al.*, 1995; Hong and Ellis, 1996; Desai *et al.*, 1997; Hong *et al.*, 1998; International Seed Testing Association, 1999). Seeds were collected from the natural populations of the above native taxa and voucher specimens were kept in the recognized Herbarium of the Mediterranean Agronomic Institute at Chania (MAICh). Special care was taken during the collection of the rare and threatened species to ensure the survival of their natural populations. Geographical data were plotted on a Digital Elevation Model (DEM) of Crete using the Geographical Information System (GIS) ARCVIEW 3.1 software so that distribution maps of the plant populations in Crete could be created.

Results and Discussion

1. Infrastructure – Seed Bank

1.1. Dry room

This has automatically controlled temperature (15–20°C) and relative humidity (15–20%). Room dimensions are: 2.75 × 3.00 × 2.80 m. A dehumidifier of MUNTER type, model MH 240, controls the humidity.

1.2. Cold room

This is automatically controlled to a temperature of -18 to -20°C. Room dimensions are: 3.75 × 4.50 × 2.80 m.

1.3. Seed bank laboratory

This has the appropriate infrastructure such as 3 growth chambers (Model AGP 600 – TECNOLAB Spain) for germination tests plus cleaning facilities, balance, etc.

2. Collection and Organization of Information

The information collected from the bibliography and in the field was recorded and organized in a database. The database fields fall into three main categories, given below.

2.1. Taxonomy-biology-ecology

Information concerning the taxonomy of each plant includes: family, genus, species, author, subspecies, author and synonyms. The 198 taxa under study belong to 33 families and 103 genera. The family of *Caryophyllaceae* has the largest representation (30 taxa).

For information relating to the biology and ecology of the plants, the database fields include: parameters that characterize the biotopes (altitudinal zones, topography, vegetation, soil); type of bioform; biological cycle; plant size; flowering period; and description of seed and fruit. The diversity of bioforms encountered among the target taxa is shown in Figure 47.1.

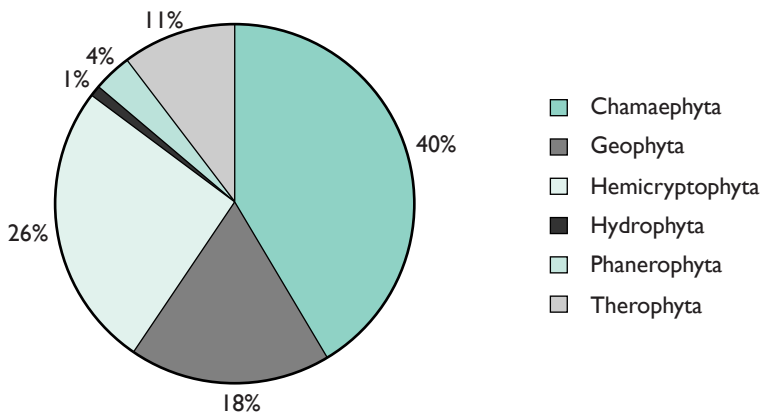


Figure 47.1 Bioforms represented among the 198 endemic and threatened target taxa of the Seedbank at MAICh (in %).

2.2. Endemism – conservation status – protection

According to the Red Data Book of Rare and Threatened Plants of Greece (Phitos *et al.*, 1995), 66 plant species are threatened in Crete, 14 of which are endangered, 34 are vulnerable, 17 are rare and one is probably extinct (*Astragalus idaeus*). Of the above species, 53 are endemic to Crete. In addition, 119 of the 198 target taxa are included in the IUCN's Red List of Threatened Plants (Walter and Gillett, 1998). National and international conventions and law protect the rare flora of Crete. Of the 198 taxa under study, 113 are included in the Greek Presidential Decree 67/81, 16 in the Bern Convention (1979, rev. 1992), three in the CITES convention (1973, rev. 1997) and 13 are recorded in the EU Directive 43/92, eight of which are considered to be priority species for protection. The populations of some species are located in protected areas, such as the Samaria National Park in the White Mountains. The largest grove of Cretan date palms, *Phoenix theophrasti*, has been fenced in and is monitored by the Forestry Service. A small Nature Reserve has also been established to protect a population of the endemic orchid *Cephalanthera cucullata*.

2.3. Geographical distribution of threat in Crete

During the implementation of the project, it was observed that despite the above-mentioned measures of protection, the natural populations of several species were disturbed and significantly threatened due to their locations in areas of Crete where human impact is intense.

Figure 47.2 shows that most of the endemic and threatened taxa (40%) are located in the mountainous areas of the island. Here, a change from traditional livestock farming to more intensive practices, as well as the construction of new roads for the transportation of fodder and products, even on the alpine zones, has been observed. In addition, in the same mountainous areas, an increase in the number of tourists (alpinists) has the potential to increase the number of related tourist activities such as the construction of small hotels, new roads and paths, etc.

Twenty-three per cent of the target species are found in the lowlands and lower hills (Figure 47.2). In these areas, agricultural practices have expanded and have led to the intensive cultivation of olive trees, the construction of greenhouses, and an excessive use of herbicides and artificial fertilizers. In addition, a decrease in the diversity of the native species and an increase in the number of invasive species have been observed.

A small percentage (8%) of the endemic species can be found in the coastal areas and on the offshore islets around Crete (Figure 47.2).

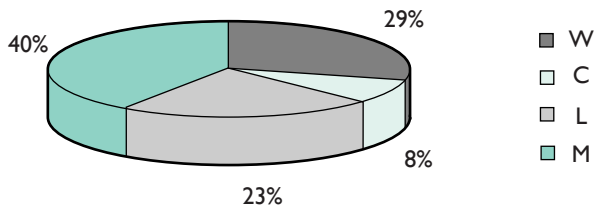


Figure 47.2 The altitudinal distribution of the endemic and threatened plants of Crete (number of taxa in %; W: of wide distribution, C: coastal areas, L: lowlands, M: mountainous areas >800m).

3. Collection and Conservation of Plant Genetic Material (Seeds) – Database for the Seedbank Management

After the first year of collection, 285 seedlots have been conserved in the Seedbank at MAICH, representing 135 of the 198 target taxa (67%). Each seedlot corresponds to a specific population of each taxon or to different populations found in geographical areas located close to one another. The size of the seedlots varies from tens to thousands of seeds. The seed collection areas can be seen in Figure 47.3. Seeds were not collected from 39 taxa (20%) because these could not be located, as was the case for rare species with a narrow geographical distribution, and because the bibliographical data on distribution were not sufficient. Some of these species may already be extinct, e.g., *Astragalus idaeus*. Twenty-five species (13%) were not collected despite the fact that their populations have been located. Seed collection from these taxa was not possible for the following reasons: a) the populations were disturbed due to overgrazing, road and building constructions, etc.; b) the fact that the populations are located in inaccessible areas, e.g., rocky areas and steep slopes; and c) the seed production of these plants was small due to their particular reproduction system, e.g., monocarpic perennials. In the database that is used in the management of the seed bank, special information is recorded relating to each seedlot: date of collection; locality; geographical coordinates; name of collector(s); herbarium number; collection method (from plants or from the ground); number of plants collected; degree of seed maturity; date of entry in the dry room; date of cleaning; date of storage; total weight of seedlot; estimation of seed number; viability tests; germination tests and results; and remarks.

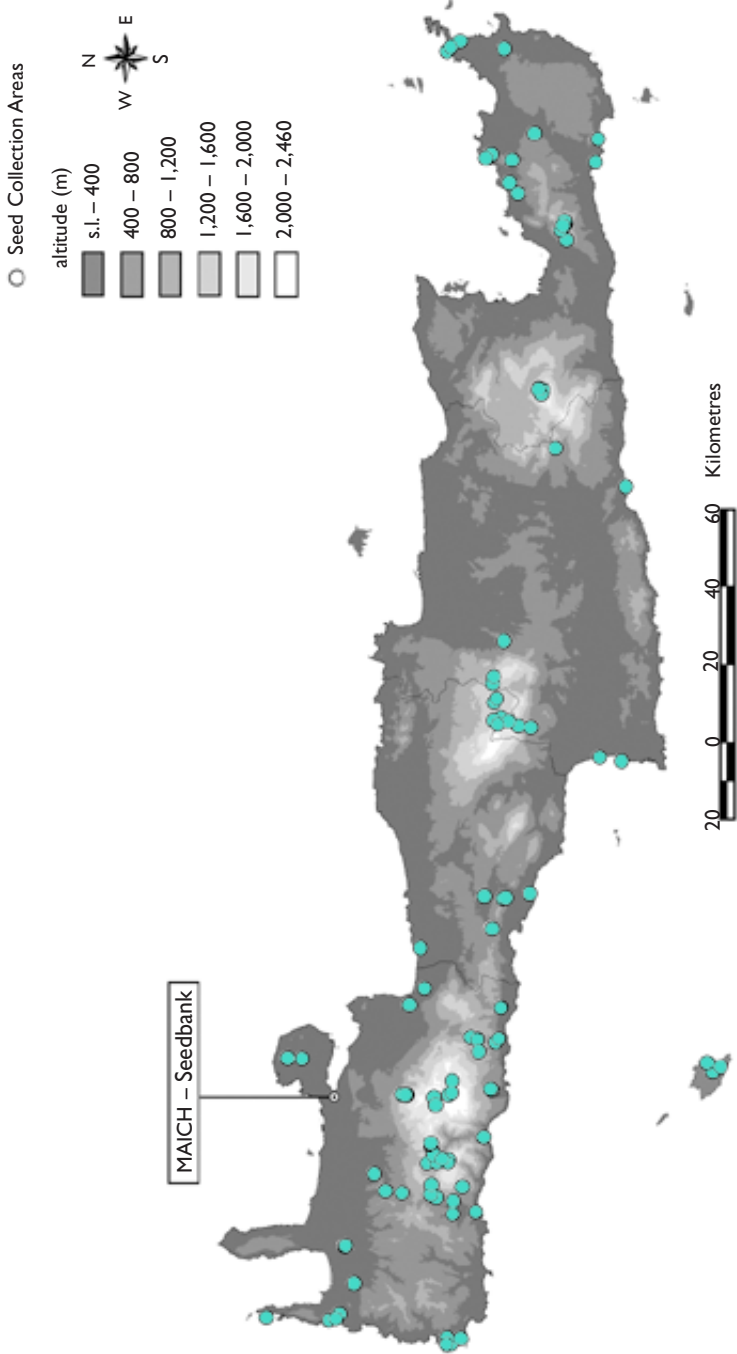


Figure 47.3 Geographical distribution of the seed collection areas in Crete (34° 55' - 35° 41' N; 23° 30' - 26° 19' E).

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