

The *MEDUSA* Information System: a Tool for the Identification, Conservation and Sustainable Use of Mediterranean Plant Diversity

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Abstract

The *MEDUSA* Network (Identification, Conservation and Use of Wild Plants in the Mediterranean Region) is concerned with gathering information on all the native plants of the Mediterranean region that are useful to man. The objectives of the Network are (a) the identification of native and naturalised plants of the Mediterranean Region, according to their uses (b) the creation of a Regional Information System that with information on plant nomenclature, chemistry, habitat description, uses, conservation, including references to literature sources and (c) the evaluation of the conservation status and of the potential utilisation in agriculture of these plants as alternative minor crops.

The eventual aim of the Network is to propose methods for the economic and social development of rural areas of the Mediterranean Region, using ecologically-based management systems that will ensure the sustainable use and conservation of plant resources of the area. These plant genetic resources are of actual or potential importance to agriculture, various industries and human health, and consequently will improve the quality of life. The particular goal of the Network is the exploration of possibilities for the sustainable utilisation of such resources as alternative crops for the diversification of agricultural production for improved product quality. Furthermore, the information collected in the *MEDUSA* database will provide the basis for projects aimed at protecting the valuable cultural heritage represented by these plants and ensuring their survival via 'conservation through use.'

INTRODUCTION

Wild plants have always been significant in all cultures of the Mediterranean region, being used for food, medicines, fuel and many other purposes. The great interest in the use of wild plants has been based on the assumption that plant resources will be available on a continuing basis. However, no concerted effort has been made to ensure this in the face of the threats posed by overexploitation caused by increasing demand, increasing human population and extensive destruction of the plant-rich habitats of the Mediterranean ecosystems. The Mediterranean basin contains approximately 25 000 species, about half of which are endemic to the region (Quézel, 1985; Greuter, 1991; Heywood 1995), and is one of the world's major centres of plant diversity (Davis et al., 1994), as well as being one of the centres of diversity for crop plants. Many crop relatives occur in the Mediterranean basin (Harlan, 1995; Heywood and Zohary, 1995; Zohary and Hopf, 1993).

THE *MEDUSA* NETWORK

A network on the 'Identification, Conservation and Use of Wild Plants in the Mediterranean Region' called *MEDUSA*, was formally established in 1996. The *MEDUSA* Network deals with gathering information on all the native plants of the Mediterranean region that are useful to man including details of their conservation status, geography, habitat and especially documenting knowledge concerning their uses.

More specifically, the objectives of the Network are:

- a) The identification of native and naturalised plants of the Mediterranean Region, used as: Food, Food additives, Animal food, Bee plants, Invertebrate foods, Materials, Fuels, Social Uses, Vertebrate Poisons, Non-Vertebrate Poisons, Medicines, Environmental Uses, and Gene sources.
- b) The creation of a Regional Information System that includes: scientific plant name and authority, vernacular names, chemical data, distribution, habitat description, uses, conservation status, geography, present and past ways of trading, marketing and dispensing, and indigenous knowledge, including references to literature sources.
- c) Evaluation of the conservation status and of the potential utilisation in agriculture of these plants as alternative minor crops.

The *MEDUSA* Network intends to propose methods for the economic and social development of rural areas of the Mediterranean Region, using ecologically-based management systems that will ensure the sustainable use and conservation of plant resources of the area. These plant genetic resources are of actual or potential importance to agriculture, various industries and human health, and consequently will improve the quality of life. The particular goal of the Network is the exploration of possibilities for the sustainable utilisation of such resources as alternative crops for the diversification of agricultural production for improved product quality. Furthermore, the information collected in the *MEDUSA* database will provide the basis for projects aimed at protecting the valuable cultural heritage represented by these plants and ensuring their survival via 'conservation through use.'

THE *MEDUSA* DATABASE

The database has been developed as free-standing programme. It enables those inputting data to follow a quick, menu driven procedure and one which standardises as far as possible the entry format, whilst allowing possibilities for input of relevant textual material where appropriate.

It has been designed to overcome two major problems:

- (a) Inconsistency of taxonomic information. This was difficult matter, partly because of the inconsistency of different floras being used in the Mediterranean region, and partly because of genuine taxonomic uncertainty. In the taxonomic information part of the programme we have asked for as much information as possible about the way that each plant name has been identified, hoping that this will make editorial comparison of different entries easier and more reliable, though obviously genuine difficulties will not always be resolved.
- (b) Inconsistency of detailed USE information. Inevitably, each record varies in the extent to which detailed knowledge of the uses of the plants in question varies. We are receiving reports from several correspondents on some plants and need to be able to compile the information accurately. To aid this, all the questions are formulated in a standard format. This enables records to be compared on a like-for-like basis for users searching the database. For the use categories, field and levels, the structure of the database has followed mostly the Economic Botany TDWG standards (Cook, 1995). This was intended to ensure compatibility between the *MEDUSA* database and other related databases. Furthermore, since no correspondent can be an expert in everything, many records are forwarded to further experts' in particular fields, to enable supplementary information to be added. Consistency of format greatly aids this task. Of course, not all the questions are relevant to each plant or to every use category but the benefits of consistency of information format will, we hope outweigh any inconvenience during data entry. We have tried to make it quite easy for correspondents to 'escape' from irrelevant fields, but not so easy that important relevant information will be missed.

There are three aspects to the *MEDUSA* database: Entering data; Editing data; and Searching the database.

Data Entry

For entering data each user has a unique User-ID and password. On entering the questionnaire, the user is offered a number of screens, starting with information about the plant: The accuracy of the taxonomic information is the crucial cornerstone of the *MEDUSA* database because it will enable the comparison of records from different users. So names of genus, species, subspecies and taxonomic authorities must be reported as well as the source of identification. Preference is given to Flora Europaea or Medcheck List where this is possible. Only plants native to the Mediterranean region are included. In addition, to be included in the *MEDUSA* database, plants should be, or have recently been, traded at some level. Information is requested on the level of trade as well as of the use for which it is traded. One or more common names for the plant in the country language are given. Information on the conservation status of useful Mediterranean plants is an important aspect of *MEDUSA*. The IUCN threat categories are used (Walter and Gillett, 1998 & <http://www.wcmc.org.uk/species/plants/plants-by-taxon.htm>). Information on endemism and if the plant exists in a seed bank is also requested. In habitat information, habitat type, soil preference, life-form and altitude range are included. Also geographical distribution in each country is reported.

Specific Use information comes afterwards:

- 1) Food: Food including beverages for humans only
- 2) Food additives: Processing agents and other additive ingredients which are used in food preparations
- 3) Animal food: Forage and fodder for vertebrate animal only
- 4) Bee plants: Sources for honey production
- 5) Invertebrate food: Only plants eaten by invertebrates useful to humans, such as silkworms, lac insects and edible grubs
- 6) Materials: Woods (not fuel), fibres, cork, cane, tannins, latex, resins, gums, waxes, oils, essential oils, lipids, etc. and their derived products
- 7) Fuel: Fuel-wood, charcoal, petroleum substitutes, fuel alcohols etc
- 8) Social uses: Plants used for social purposes, which are not definable as food or medicines, for instance masticatories, smoking materials, narcotics, hallucinogens and psychoactive drugs, contraceptives and abortifacients and plants with ritual or religious significance
- 9) Vertebrate poisons: Plants which are poisonous to vertebrates, both accidentally and usefully e.g. hunting, fishing
- 10) Non vertebrate poisons: Both accidentally and useful poisons (e.g. molluscicides, herbicides, insecticides) to non-vertebrate animals, plants, bacteria and fungi
- 11) Medicines: Both human and veterinary
- 12) Habitat and landscape modification: Plants used for erosion control, shade, shelter, restoration and rehabilitation, ornamentals, soil improvers, boundaries, firebreaks, pollution control etc.
- 13) Gene sources: Wild relatives of major crops which may possess traits or qualities such as disease resistance, cold hardiness etc. Of value in breeding programmes

Following each use come further categories related to the specific use, e.g. for food additives there are choices for adulterants, colourings, flavourings etc. Then, information is requested on the relevant parts of the plants that are used for this purpose and details of the sort of compounds thought to be related with the specific use, along with biographical information, wherever available. Finally, following a similar approach to the geographical distribution of the plant, the geography of use is recorded.

Data Editing

After records have been received from the contributors they are edited in house and by thematic external experts (taxonomy, chemistry etc.). Records from different sources are compared and additional data sought from experts where possible. This work is the main task of the *MEDUSA* team at present and significant progress in editing the material is now being made.

Searching the Database

Although many *MEDUSA* records are still incomplete, the database is now accessible for searching online. One can search the database by genus, species, use, plant parts used, use-related chemistry and country. The *MEDUSA* database is available on line on the internet at the address: <http://medusa.maich.gr>

CURRENT STATUS OF THE *MEDUSA* DATABASE Data collection started on the beginning of 2000. Records were received from Algeria, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Malta, Morocco, Portugal, Syria, Spain and Tunisia and are expected from Turkey. As of the end of August 2001, 1411 plant records had been incorporated into the database with a total of 2841 records defined by use. Figure 1 shows the number of records received from each country. With regard to the IUCN status, figure 2 shows to number of plants that fall in each threat category. In Figure 3 all threat categories have been grouped together, the proportion of threatened to non-threatened plant records is presented; overall it seems that the majority of plants that are used in the Mediterranean are not threatened. The comparison of conservation status and conservation measures shown in Figure 4 indicates that only 14 % of the plant records are known to exist in local Seed Banks; 2.6 % are found in protected areas; 19.8 % of the total records represent threatened plants while 10.8 % represent endemic species. It is quite alarming that only 0.7 % of the threatened taxa and only 0.3 % are known to exist in local Seed Banks; finally 3 % of the plants are both threatened and endemic in their country.

Considering the trade of wild plants, 30 % of the plants are not traded, 27 % are traded only locally, 26 % are traded nationally and finally 9 % are traded within EU and a further 8 % is traded in beyond EU (Figure 5).

Finally, Figure 6 shows the number of uses that have been reported. The high number for 'medicine', 35 %, points out that there is a great tradition with medicinal plants in the Mediterranean and that further actions should be taken for those plants. The use categories for food (12 %), food additives (8 %), animal food (8 %), materials (10 %) and environmental uses (8 %) are also considerably reported in *MEDUSA* database.

The above results have been extracted from the database after 18 months of data input by *MEDUSA* contributors. However data input still continues and much work remains to be done by the thematic editors.

CONCLUSION

Once completed as a normative pilot system, the *MEDUSA* database will have global application in the enhancement of agricultural biodiversity and thus food and income security. Local communities play an important role in the exploitation of agrobiodiversity, for example in harvesting and seed collection, and this aspect of agricultural development is reflected, especially in the fields of information to be gathered. One should take in consideration that a great amount of information on these plants is available, but is fragmented, unstandardized, hidden or inaccessible. This project brings together plant specialists from the Mediterranean basin to identify common interests, find solutions to common problems and share information with the ultimate aim of contributing to the development of national and regional plans for the conservation and sustainable use of promising wild species and the equitable sharing of the benefits derived from them, in accord with the principles set out in the Leipzig Plan of Action.

ACKNOWLEDGEMENT

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Literature Cited

- Cook, F.E.M. 1995. Economic botany data collection standards, prepared for the international working group on taxonomic database for plant science (TDWG), Royal Botanic Gardens Kew.
- Davis, S.D., Heywood, V.H. and Hamilton, A.C. (eds) 1995. Centres of Plant Diversity. A guide and strategy for their conservation. Volume 1: Europe, Africa, South West Asia and the Middle East. WWF and IUCN. IUCN Publications Unit, Cambridge UK.
- Greuter, W. 1991. Botanical diversity, endemism, rarity, and extinction in the Mediterranean area: an analysis based on the published volumes of Med-Checklist. *Bot. Chron.* 10: 63–79.
- Harlan, J.R. 1995. Agricultural origins and crop domestication in the Mediterranean region. *Diversity* 11: 14–16.
- Heywood, V.H. 1995. The Mediterranean flora in the context of world diversity. *Ecologia Mediterranea* 21: 11–18.
- Heywood, V.H. and Zohary, D. 1995. A Catalogue of the Wild Relatives of Cultivated Plants Native to Europe. Pp. 41. Council of Europe and Orto Botanico di Palermo, Regione Siciliana, Assessorato Agricoltura e Foreste, Palermo.
- Quézel, P. 1985. Definition of the Mediterranean region and the origin of its flora. 9–24. In: Gómez-Campo, C. (ed), *Plant Conservation in the Mediterranean area*, W. Junk, Dordrecht.
- Walter, K.S. and Gillett, H.J. [eds] (1998). 1997 IUCN Red List of Threatened Plants. Compiled by the World Conservation Monitoring Centre. IUCN - The World Conservation Union, Gland, Switzerland and Cambridge, UK.
- Zohary, D. and Hopf, M. 1993. *Domestication of plants in the Old World*. ed.2. Clarendon Press, Oxford.

Figures

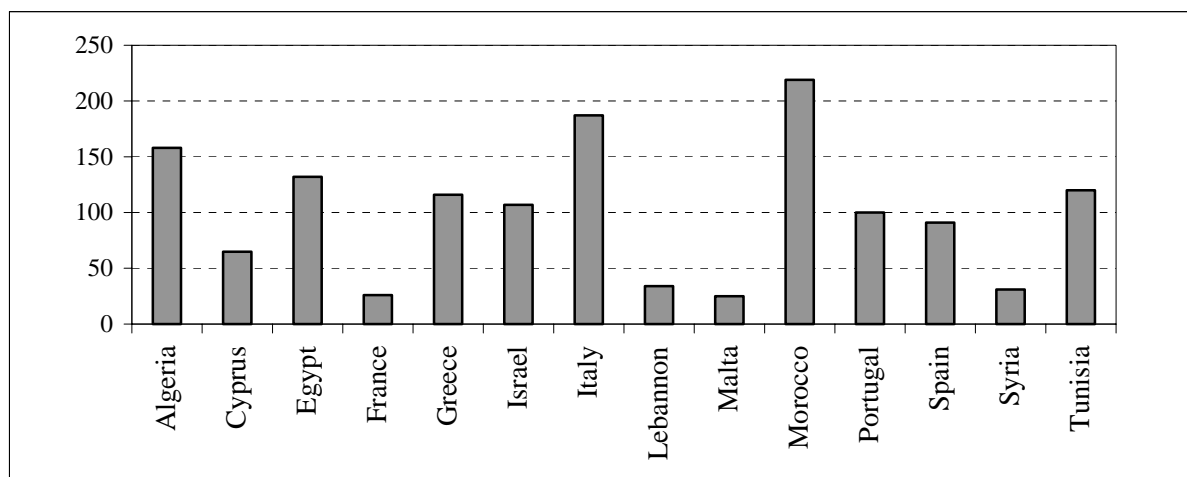


Fig.1. Number of records received from each Mediterranean country.

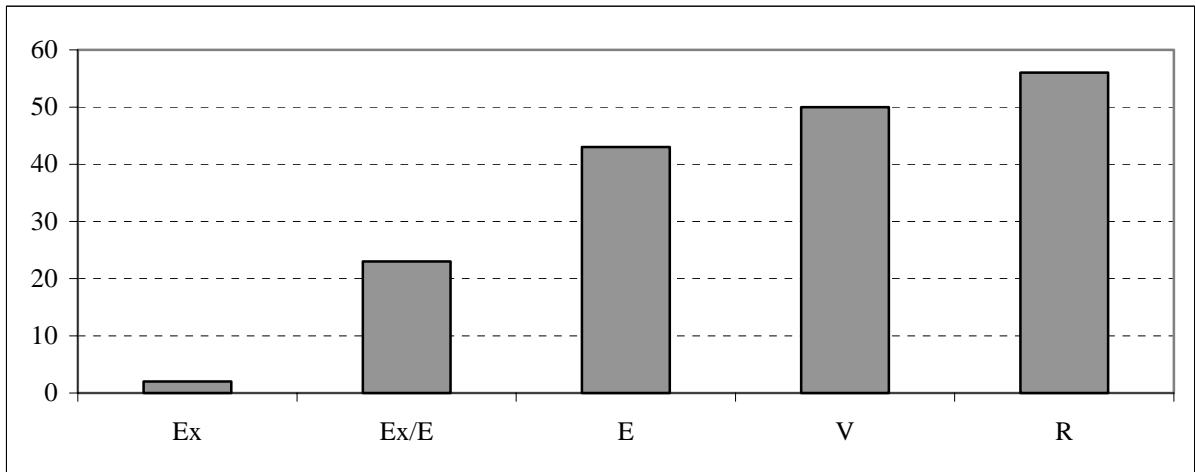


Fig. 2. Number of records falling into each IUCN threat category, Ex: extinct, Ex/E: possibly extinct, E: Endangered, V: vulnerable, R: rare

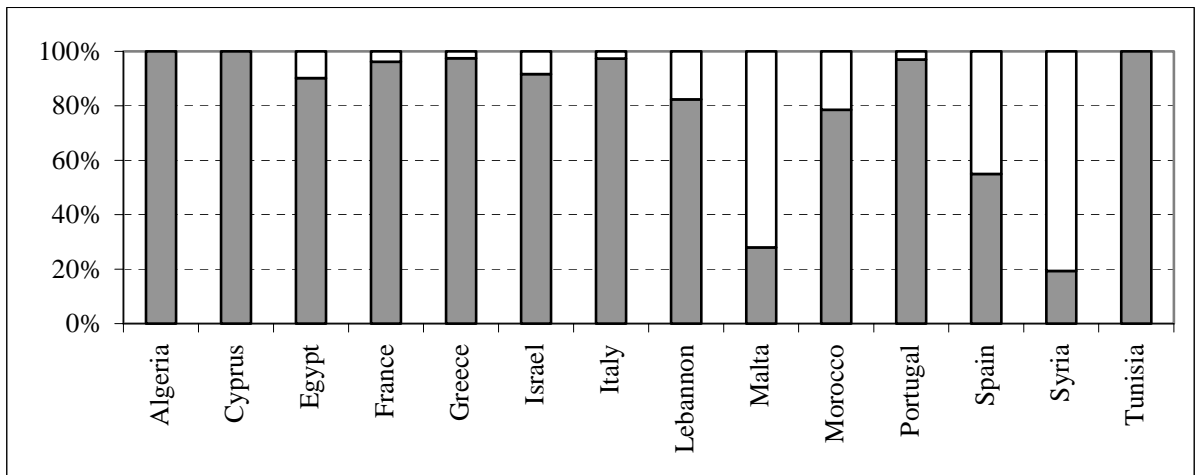


Fig. 3. Proportion of threatened (white parts) to non threatened (dark parts) plant records from each country.

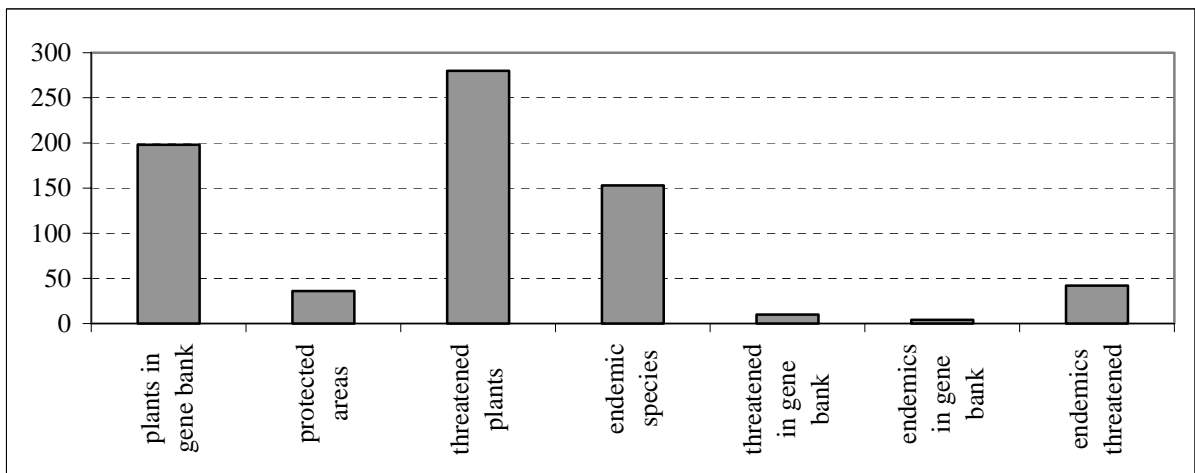


Fig. 4. Comparison of threat status and conservation measures.

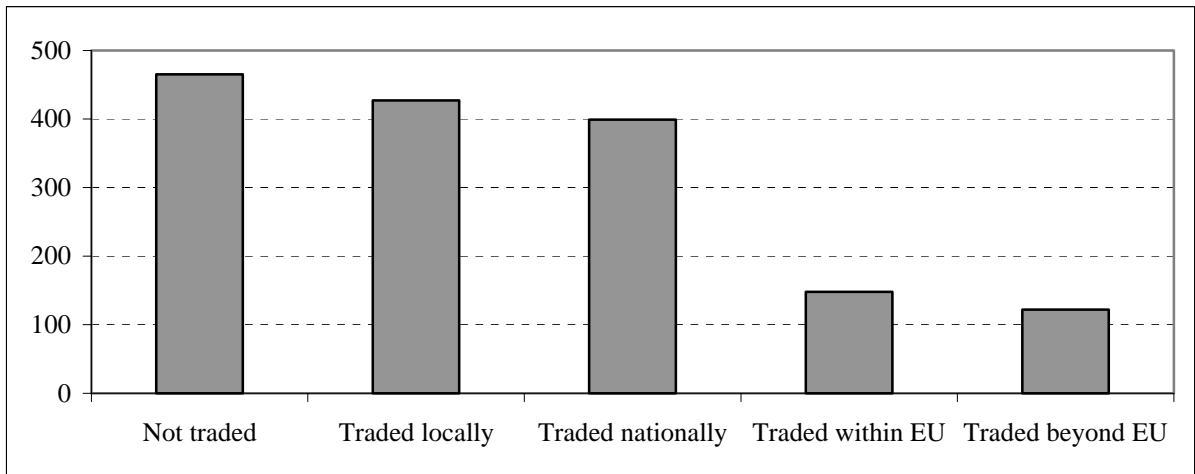


Fig. 5. Distribution of trade profile of all plant records.

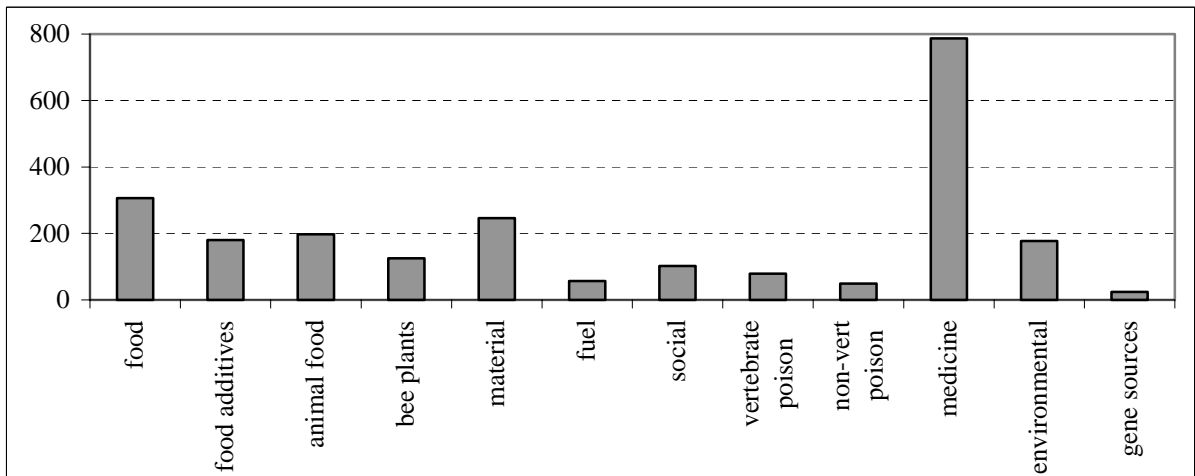


Fig. 6. Distribution of use categories of all plant records.