

Diego Sabato & Leonor Peña-Chocarro

M_aNA MARIS NOSTRI
NOVUS ATLAS

Project

Seeds and fruits from the Mediterranean Basin

Doce Calles
EDICIONES

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I. Introduction

The identification of seeds and fruits is a routine element in several disciplines, not only those related to botany and agronomy, but also of others like archaeobotany, ethnology or even forensic sciences. It can also be applied to numerous fields such as weed control and food, pharmaceuticals or the cosmetic industries among others. In all of them, an accurate identification is key and, according to the authors' expertise, crucial for the interpretation of data. Several universities, botanical gardens and archaeobotanical labs house seed collections whose creation and maintenance is often costly and time consuming (Nesbitt et al. 2003).

Botanical guides such as those created by Hubbard (1954, 1984), Behrendt and Hanf (1979), Davis and Cullen (1979), Villarías (1986), and De Rougemont (1989), and descriptions of regional flora, such as *Flora iberica* (Castroviejo 1986-2019), *Flora d'Italia* (Pignatti and Anzalone 1982) or *Flora Europaea* (Tutin et al. 1964-1980), among others, are very useful for the identification of plants. However, they focus on seeds only when these are essential for the identification of particular species. The first atlases and manuals aimed at the identification of seeds and fruits were published over sixty years ago, and continued to be produced during the '80s and '90s (Bertsch 1941, Martin 1947, Beijerinck 1947, Berggren 1969, Delorit 1970, Berggren 1981, Hanf 1983, Anderberg 1994; see also Jensen 1998 and Nesbitt and Greig 1989 and references therein). These pioneering works, which laid down the foundations of diaspore identification, continue their legacy in modern websites^{1,2,3,4} and printed publications (Cappers et al. 2006, Jacomet 2006, Knapp 2006, Nesbitt 2006, Bojňanský and Fargašová 2007, Knörzer 2007, Cappers et al. 2009, Knapp 2010, Cappers and Bekker 2013), as well as in manuals specifically oriented to the identification of archaeological

plant remains (Katz 1965, Jacquat 1988, Schoch et al. 1988, Neef et al. 2011).

Yet most of the aforementioned references focus on a specific group of plants and/or on a particular geographical region, mainly North and Central Europe, and they only partially include native taxa from the Mediterranean basin, leaving researchers working with plant remains from this geographic area with a disadvantage. This is how the idea of the *MaNNA* project (*Maris Nostris Novus Atlas*) was born at the beginning of 2015. Driven by our desire to share knowledge on seed identification with scientists from all over the world, we decided to create a new compendium of high-quality images of seeds, fruits and other dispersal units of Mediterranean plants to facilitate their taxonomic identification. Some of these taxa have never been recorded in such rich detail, particularly the smallest seeds and those belonging to endemic species. Our project does not claim to be an exhaustive guide, but only a practical tool that can assist the process of daily identification, which requires detailed studies based on specific literature and reference plant material.

1.1. The collection

The PSSP (Paleoeconomía y Subsistencia de las Sociedades Preindustriales / Palaeoeconomy and Subsistence of Pre-industrial Societies) Research Group (formerly Archaeobiology Research Group) is based at the Institute of History of the Spanish National Research Council (CSIC), the largest public institution dedicated to research in Spain and the third largest in Europe⁵.

Back in the '90s Dr. Leonor Peña-Chocarro set up the Archaeobotany section of the Archaeobiology laboratory, one of the few laboratories dedicated to this discipline in

¹ Digital Plant Atlas. Groningen Archaeological Studies, University of Groningen. www.plantatlas.eu. [Accessed February 01, 2021].

² Seed Identification Guide 2018. www.idseed.org [Accessed February 01, 2021].

³ Family Guide for Fruits and Seeds, vers. 1.0. <https://nt.ars-grin.gov/seedsfruits/keys/frsdfam/index.cfm>. [Accessed February 01, 2021].

⁴ Atlas Digital de Semillas de las Islas Canarias, Centro de Agrobiodiversidad de La Palma (CAP). www.atlasdesemillasdecanarias.org [Accessed February 01, 2021].

⁵ From CSIC website: <http://www.csic.es> [Accessed February 01, 2021].



Fig. 1. The collection at the PSSP laboratory at the Institute of History, CSIC, Madrid.

Spain, and started building up a reference collection from a small assemblage (ca. 400 species) that had been collected by the former archaeobotanist A. M. Aranz. Over the last fifteen years the collection has significantly expanded thanks to the collaboration between PSSP and over one hundred institutions and researchers worldwide. Most of the accessions currently held in this reference collection have been obtained from Botanical Gardens by annual requests through their *Index Semina* (see Appendix 2).

Some species, particularly of domesticated plants such as cereals and legumes, have also been acquired from traditional farmers as part of research projects carried out across the Mediterranean. In most cases, this 'ethnographic' collection does not include modern breeding lines. The collection currently holds around 5500 accessions corresponding to 3800 taxa (Fig. 1). It was originally created on the basis of the *Flora iberica*⁶, and this is why native plants to the Iberian Peninsula are better represented than those native to other Mediterranean areas.

1.2. The MaNNA project

The Atlas title, **Maris Nostris Novus Atlas**, literally translated as "The new Atlas of the *Mare Nostrum* (the Roman name

of the Mediterranean Sea)" is a tribute to Latin which was the ancient lingua franca of this geographic area that connected people from different cultures and origins.

This project focuses on wild and economic native plants from various Mediterranean countries. Portugal has also been included since it is part of the Iberian Peninsula. The selection of species is based mainly on information taken from the databases of *Euro+Med PlantBase*⁷ and *Germplasm Resources Information Network (GRIN)*⁸. Some non-native archaeophytes, plants introduced before the 15th century, have also been included.

The project was carried out within the framework of CSIC's PIE project 201710E017, directed by Dr. L. Peña-Chocarro. Funds were primarily directed for the employment of Dr. Diego Sabato, who developed the photographic database and organized the atlas. Dr. Duilio Iamónico was responsible for the taxonomic revision.

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⁶ Printed version: Castroviejo S. (Gen. Coord.) 1986-2019. *Flora iberica*. 1-18, 20-21. Real Jardín Botánico, CSIC, Madrid. Websites: <http://www.floraiberica.es/> and (ANTHOS associated project) <http://www.anthos.es/index.php?lang=en> [Accessed February 01, 2021].

⁷ Euro+Med (2006-): Euro+Med PlantBase - the information resource for Euro-Mediterranean plant diversity. Published on the Internet <http://www2.bgbm.org/EuroPlusMed/> [Accessed February 01, 2021].

⁸ Germplasm Resources Information Network. Beltsville (MD): United States Department of Agriculture, Agricultural Research Service. Available from: <http://www.ars-grin.gov/>. [Accessed February 01, 2021]

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USING THE ATLAS

The collection is organized according to five size groups*



EXTRA LARGE
Unit > 10mm



...like a broad bean seed



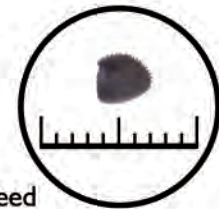
LARGE
5mm < Unit ≤ 10mm



...like a wheat caryopsis



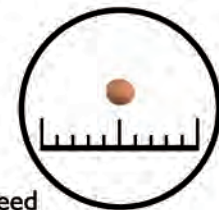
MEDIUM
2mm < Unit ≤ 5mm



...like a corn-cockle seed



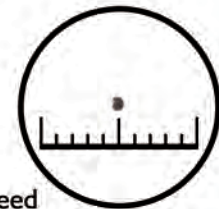
SMALL
1mm < Unit ≤ 2mm



...like a white mustard seed



EXTRA SMALL
1mm ≤ Unit



...like a poppy seed

* For detailed information about how units have been selected and organized see Chapter 2

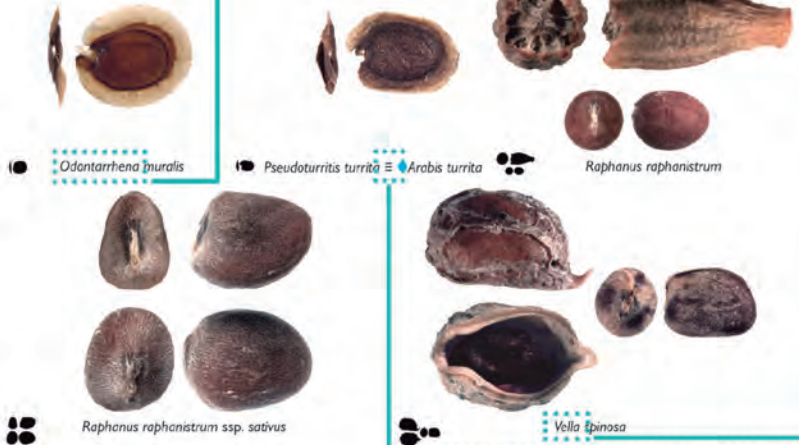
USING THE ATLAS



Brassicaceae

Odontarrhena - Vella

First and last genus of the size group



● *Odontarrhena muralis* ● *Pseudoturritis turrita* ≡ *Arabis turrita* ● *Raphanus raphanistrum*
 ● *Raphanus raphanistrum* ssp. *sativus* ● *Vella spinosa*

This symbol stands for a synonym

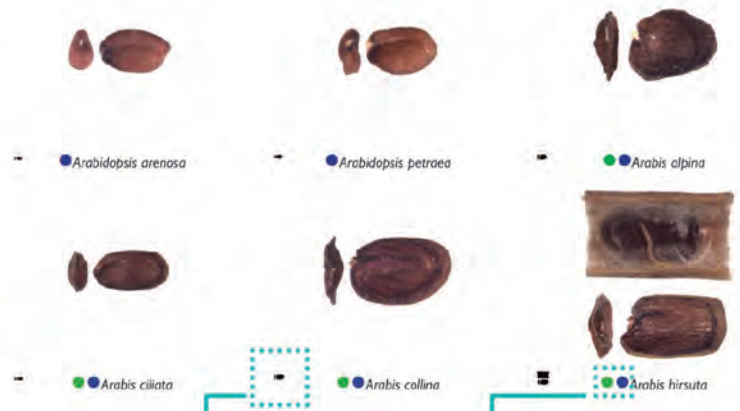


Brassicaceae

Arabisopsis - Arabis

This icon represents the size group and the scale bar

- Brassicaceae
- XL
 - L
 - M
 - S
 - XS



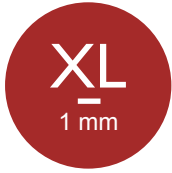
● *Arabidopsis arenosa* ● *Arabidopsis petraea* ● *Arabis alpina*
 ● *Arabis ciliata* ● *Arabis collina* ● *Arabis hirsuta*

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This information appears in each page as a reminder of the family name and the size group(s)

Black silhouettes represent the unit in its real size

Circles indicate the presence of other accessions for the genus in different size groups (in this case *Arabis* in the M and XS groups)



Boraginaceae

Solenanthus



Solenanthus scardicus



Boraginaceae

Anchusa - Onosma



● *Anchusa azurea*



Borago officinalis



● *Cerinthe major*



Cynoglossum cheirifolium



Cynoglossum creticum



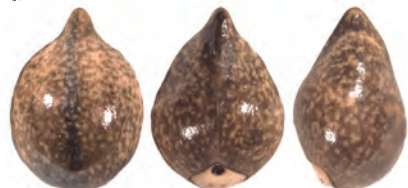
Cynoglossum montanum
≡ *Cynoglossum germanicum*



Cynoglossum officinale



Huynhia pulchra



● *Onosma frutescens*

Boraginaceae

XL

L

M

S

XS



Boraginaceae

Aegonychon - Echium



Aegonychon purpurocaeruleum ≡ *Buglossoides purpurocaerulea*



Alkanna graeca



Alkanna orientalis



Alkanna tinctoria



● *Anchusa officinalis*



Buglossoides arvensis



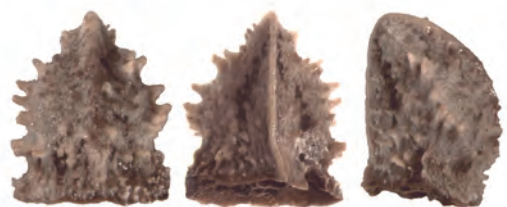
● *Cerinthe glabra*



● *Cerinthe minor*



Echium angustifolium



Echium boissieri



Boraginaceae

Echium - Lycopsis



Echium creticum



Echium italicum



Echium lusitanicum



Echium parviflorum



Echium vulgare ssp. *vulgare*



Glandora rosmarinifolia



Heliotropium supinum



Lappula squarrosa



Lithospermum officinale



Lycopsis arvensis ≡ *Anchusa arvensis*

Boraginaceae

XL

L

M

S

XS



Boraginaceae

Nonea - Symphytum



Nonea lutea



Omphalodes linifolia



Onosma cinerea



Pulmonaria mollis



Onosma visianii



Pulmonaria rubra



Pulmonaria officinalis



Symphytum officinale



Symphytum bulbosum





Boraginaceae

Arnebia - Myosotis



Arnebia hispidissima



● *Heliotropium europaeum*



Myosotis alpestris



Myosotis arvensis



Myosotis discolor



Myosotis ramosissima



Myosotis scorpioides



Myosotis stricta



Myosotis sylvatica ssp. *elongata*



Maris Nostri Novus Atlas: Seeds and fruits from the Mediterranean Basin

A new atlas to help identify Mediterranean seeds and fruits

Authors: Drs Diego Sabato and Leonor Peña-Chocarro

This is the first atlas of seeds and fruits of wild and economic plants from the Mediterranean Basin, in particular from the Iberian Peninsula.

The *Maris Nostri Novus Atlas* project was carried out by two archaeobotanists, Dr Diego Sabato and Dr Leonor Peña-Chocarro, researchers at the Archaeobiology Laboratory of the Institute of History which is part of the CSIC (Spanish National Research Council). The atlas comprises an extensive assemblage of high-resolution pictures from different angles of seeds and fruits accompanied by an intuitive and simple search system. Entries are organized by size range instead of in traditional alphabetical order so as to facilitate comparing specimens of the same size. A life-size image reference is also included for each sample.

This atlas is a practical guide aimed at facilitating the daily tasks of both specialists and amateurs who need to identify seeds and fruits. It is likewise a key tool serving not only archaeobotany or botany, but related disciplines.

The volume, initiated in 2015 by means of a painstaking photographic catalogue and classification, includes 2,608 specimens (species, subspecies and varieties) forming part of 880 genera and 134 families. Moreover, the assemblage represents approximately 10% of the vascular flora of the Mediterranean.

Strengths:

User-friendly: The atlas can be applied directly for routine laboratory tasks. In this sense, this book is conceived to be used intuitively as it is not hampered by lengthy texts.

High-resolution images: All the book's images are of high quality and in many cases not currently available on the market.

Focused on the Mediterranean: The book includes specimens not found in other atlases. It is therefore particularly useful for researchers focusing on this region.



Doce Calles
EDICIONES

