

1. Introduction

Every anatomical atlas covers a defined group of plants or a specific region. The idea of producing this reference book arose from the lack of an extensive descriptions of the wood structure of trees and shrubs indigenous to the Eastern Mediterranean, and the continuing demand for wood identification in that region (Lev-Yadun 2008). The primary aim of this atlas is to present the range of anatomical features occurring in lignified plants from the Eastern Mediterranean, in order to facilitate plant material identification. Secondly, it is intended to create a basis for ecological anatomy, comparative ecophyletic and archaeological studies. Here we present a wide range of taxonomically important anatomical features occurring in plants from Cyprus, including various habits from trees, shrubs, dwarf shrubs to some perennial herbs and woody lianas. Anatomical features of stem xylem, twig bark and pith have been described for 264 species (12 Gymnosperms, 2 Gnetales, 6 Angiosperms Monocotyledons and 244 Angiosperms Dicotyledons) belonging to 71 families.

Since former times, wood and timbers played an important role in the Mediterranean region (Meiggs 1982). Therefore, identifying plant species from archeobotanical material, historical objects, and remains belonging to the human cultural heritage is important. Identifying such material is often difficult because wood anatomical features are only partially present in plant remains. Moreover, wood of a few shrubs and dwarf shrubs, as well as wood from not commonly used trees, has been investigated in detail before. While some wood atlases for the east Mediterranean region, and for some nearby areas, have been published (Chudnoff 1956, Edlmann *et al.* 1994, Fahn *et al.* 1986, Grosser 1977, Huber and Rouschal 1954, Niloufari 1961, Parsa Pajouh and Schweingruber 1988, Saya 1957, 1959, Schmidt 1941, Schweingruber 1978, 1990) these descriptions are of limited value for identification, since they are dispersed in a number of publications, and most of them were published prior to the introduction of the IAWA codified anatomical feature lists. Recently Akkemik and Yaman (2012) published a valuable wood anatomy atlas of Eastern Mediterranean species, mainly from Turkey.

Wooden specimens are often associated with bark, mainly in archeological context. Bark has been used in many cultures for food, as a source of fibers for textiles and cordage, in medicine, as writing material, die, etc. (Sandved *et al.* 1993). Bark anatomy is still rarely presented systematically for a great number of species (Esau 1969, Roth 1981, Schweingruber *et al.* 2011, Zahur 1959). The anatomy of pith has been neglected. In fact, there is no systematic description of the anatomy of the pith region for trees and shrubs from any woody florals of the world. Here we describe in detail the twig's pith and bark anatomies by following a classification for anatomical features of those structures. Having bark and pith anatomical descriptions addresses new possibilities in plant identification. Moreover, the association of bark and pith anatomical features to ecological and biological factors, will possibly open new fields of ecophyletic and ecophysiological investigation.

Cyprus, which is the third largest island of the Mediterranean Sea, offers a great range of habitat types and a large number of typically Eastern Mediterranean species, including many endemics. On Cyprus grows about 50 endemic woody species: for almost all of them no anatomical descriptions are available. Additionally, the indigenous flora of Cyprus is taxonomically diverse due to the variety of ecological conditions found on the island and because of its close geographical position to Europe, the Middle East and northern Africa. We chose to extensively sample on Cyprus, considering that the trees and shrubs of the island are representative of the whole vegetation throughout the Eastern Mediterranean region. Almost all woody species native to the island were included, some introduced (e.g. *Eucalyptus*) or cultivated (*Citrus* spp. and *Prunus* spp.) or ornamental species (e.g. *Lantana camara*) as well as some species which have their distribution limits close to Cyprus. For genera with a distribution range that extends over the Eastern Mediterranean region (e.g. *Acer* spp., *Populus* spp.), we described only the species which grows on Cyprus.

This book differs from traditional wood atlases in some aspects which can be summarized as the follow:

- all anatomical features are presented in colour photomicrographs from double-stained sections. Sometimes microphotographs prove to be more informative than the brief descriptions removing most of the ambiguity that feature definitions alone would provide;
- the anatomy of twigs is presented systematically for each species describing details for transverse sections of bark and pith;
- the anatomy of twig wood is described in relation to its anatomical differences to stem wood.

The species are arranged in alphabetical order of genus and species, within each of the Gymnosperms, Gnetales, Angiosperm Monocotyledons, and Angiosperm Dicotyledons. Each species has a coded description with IAWA softwood or hardwood lists of microscopic feature numbers (Wheeler *et al.* 1989, Richter *et al.* 2004). For Dicotyledonous Angiosperm species, some new codified features proposed by Schweingruber *et al.* (2011) were also applied. Anatomical descriptions of stem wood are provided for transverse, radial and tangential sections to facilitate the identification process. For bark and pith codified descriptions, new anatomical features lists were developed, which are explained in the chapter Definition of Anatomical Features. Bark descriptions were difficult in many cases because of a lack of a consistent internationally accepted list of bark anatomical features. Problems occurred on the classification of the bark of Chenopodiaceae because the bark formation mode of plants with successive cambia seems to be different from those without included phloem. Sieve tubes, parenchyma cells, phelloderm and phellogen are difficult to distinguish.

In general, anatomical descriptions are brief, and details of little importance for identification, or barely visible under an optical microscope, have been omitted.

Every species included in this atlas is accompanied by a short plant description, providing information on growth form, plant height and habit, flower, leaf or fruit characters, general distribution and habitat. Accompanying each plant description is a Mediterranean basin map or a Cyprus map for endemic species. Species distribution maps are not provided for species that belong to exotic floras and that were introduced to the Mediterranean

region as ornamental plants. The key objective of identification of groups of species by using a few selected unambiguous and clearly visible features. The use of the key in conjunction with the photomicrographs should make it possible to identify almost any plant occurring in the eastern Mediterranean on the base of its stem anatomy.

It should be emphasized that the number of samples per species studied was usually restricted to one for both the stem and twig; only in few cases were two or three samples cut from different plants. We are aware of the risks for the identification that may result from our sampling strategy. With the present material it is not possible to demonstrate the species-specific anatomical variability. For references on specific families or species refer to Gregory (1994). It is also not intended to give a reference for the all work done on dendroecology in the Mediterranean region, for that refer to Cherubini *et al.* (2003), and Grissino-Mayer website (Grissino-Mayer 2013).