

Ornamental Plants in Agricultural and Botanical Treatises from Al-Andalus

Expiración García Sánchez and J. Esteban Hernández Bermejo

This study aims at introducing the most outstanding aspects of treatises written by Andalusí agronomists, and the specific knowledge they contain regarding crop species used at that time, paying special attention to those considered to be ornamental.

To do so, the first step was to analyze the richness of information gathered within these agricultural treatises, a testament to the high level of development that agriculture reached in al-Andalus. This cultural heritage had been hidden for centuries. The results of recent studies about this topic, and the perspective obtained by our multidisciplinary working method have been updated. The concept "ornamental" used by Andalusí agronomists and botanists is also analyzed. Finally, a selected catalog of ornamental flora, complemented with a global analysis, closes the study.

Documentation Sources and Working Method

This work is based on original Andalusí sources, especially those from agricultural treatises. These literal texts, which perfectly reflect the high degree of knowledge reached, consist not only of the agronomic knowledge of past cultures, but also their level of innovation in different fields. They are considered one of the most important achievements in the history of agriculture of the Iberian Peninsula during the Andalusí period. Agronomical knowledge had reached an acceptable level of development during the Roman colonization, but entered into a stagnation phase, even regressive, in Visigothic times (fifth to seventh centuries).¹

If we count the number of agricultural treatises as a determinant factor of this agronomical framework, the eleventh to thirteenth centuries can be considered particularly prolific for agronomical science. There was a first anonymous treatise written at the end of the tenth century (AA, 1990), followed by six of the eight known treatises written in the following three centuries.² Their authors were Ibn Wāfid (IW, 1997) Ibn Ḥajjāj (IH, 1988), Ibn Baṣṣāl (IB, 1995), Abū l-Khayr (AKh, 1991), al-Ṭignarī (TG, 2006) and Ibn al-'Awwām (IA, 1988). Finally, Ibn Luyūn (IL, 1975) wrote in verse his agricultural work in the middle of the fourteenth century.

Roughly speaking, Andalusí treatises follow the same pattern as other works from Classical and Oriental authors: soil, water and manure, followed by an introduction of the basic matter regarding crop science, sometimes accompanied by other aspects related to animal production or veterinary. Despite these similarities, however, a great richness of content distinguishes Andalusí texts from the former ones: after careful study, it is possible to discover the rich diversity of managed species, techniques and uses, as well as the approach to landscape and agricultural flora of the Western



Fig. 1. Fol. no. 49v from the original agricultural manuscript by Ibn Luyūn, *Kitāb ibdā' al-malāḥa wa-inhā' al-raḥāba fī uṣūl ṣinā'at al-filāḥa* (no. 14 of the funds of the Escuela de Estudios Árabes) (Granada, Spain). This detailed description of an almunia appears in the text. (Photo by E. García).

innovative elements that Andalusí agronomists provided, and even to throw light on some species whose identification was doubtful.

The information extracted from these texts has been analyzed according to an iterative method following successive stages: starting from the original Arabic term and description (not translated), its taxonomical identity is established according to modern Plant Systematics, it is then matched to its current Spanish folk name. In some cases, this identification invalidates or corrects the commonly accepted translation. This process takes into account data related to the species morphology, crop patterns, techniques and varieties, uses and consumption. This interpretation and diagnosis allows us to prove, to outline and sometimes to seriously question the identification of the species resulting from a simple translation. This method has been followed by our team of researchers who have been working on Andalusí agricultural flora for years.⁹

The Concept of “Ornamental” in Agricultural Texts

So far, the brief references to plants in studies devoted to Andalusí gardens were almost exclusively based on Arabic poetical texts,¹⁰ mainly on two genera whose monographic topics are gardens and flowers: *rawdīyyāt* (garden's) and *nawrīyyāt* (flower's). Although there are some discrepancies, it is almost unanimously accepted that these poems cannot be considered a documental source of an Andalusí garden since the authors searched for literary figures not for reflecting reality.¹¹

Regarding agricultural texts, except for on rare occasions they have not been considered representative sources of plant elements in gardens, since the main interest of these works is crop production, which is far from any aesthetic

Mediterranean area in medieval times (Hernández Bermejo and García Sánchez 1998). At the same time, it is possible to discover the foundations of Andalusí agricultural science, and to compare it with previous and later agronomical contexts.

Another important source for the development of this work is the so-called *'Umdat al-ṭabīb fī ma'rifat al-nabāt li-kull labīb* (*Medical support for the knowledge of plants by all experts*) (UM, 2004), attributed to the agronomist Abū l-Khayr, which is considered to be the most complete Andalusí botanical work to date. The main reason why this source has been added to agricultural works was its great precision in describing plant morphology, something uncommon among agronomists. The *'Umda* also provides complementary information about each plant phenology, its habitat, geographical distribution, and varieties and uses, which in many cases have been decisive for clearly identifying the species being studied. Additional information has been added to the treatises, provided by the *Kitāb al-Anwā'*, known as the *Calendar of Cordoba* (CC, 1961), a work from the tenth century written by 'Arīb b. Sa'īd. This calendar deals with very diverse topics (astronomy, agriculture, navigation, Christian and Muslim festivities...), Data supplied by this source are scarce but interesting, being the first time that some of the species cultivated in al-Andalus are mentioned.

These Andalusí texts are basic documentation sources, but it was necessary to consult other secondary sources, some written prior (Roman and Visigothic: Columela and Isidoro de Sevilla), and others that came later (Herrera, Clusius). These have been useful to value the

purpose as some authors defend. The only example, which has been used and repeated *ad nauseam*, is the description of an “*almunia*”⁸ that appears in the last Andalusí agricultural treatise by Ibn Luyūn (Fig. 1). However, there is no catalog of garden plants serving as a basis for these treatises, although recent works have already taken them into consideration.⁷

Apart from the previously mentioned reasons, mostly due to lack of knowledge, one of the main arguments for this low interest in Andalusí agricultural and botanical treatises lies in the difficulty of their study. In fact, the identification and interpretation of the phytonyms quoted in these Arabic documentation sources are particularly complex: added to the strictly philological problems, there are others such as the unavoidable polysemy (using the same popular name for different species), or on the contrary, the same species receiving several names (synonymy). All these factors provoke contradictions and mistakes when giving the Arabic term the corresponding scientific name.

Classification criteria adopted by authors of agricultural and botanical works of the past are obviously different from the ones used today, so that similarities in plant aspects, external appearance and uses often provoke the use of the same name for species that are currently considered different from the genetic point of view. Another difficulty derives from the frequent use of the same term for very close groups of taxons, which are not differentiated by non-specialized knowledge.⁹

Palynological studies are another possible information source for the study of these plants, but unfortunately, there is a minimal amount of this kind of research in historical times, and even less for those referring to the analysis of garden soils.¹

Due to these limitations, it is a must to analyze the criteria that Andalusí agronomists adopted to describe the “ornamental” use of plants. This will help when trying to establish those species considered as the plant element in gardens.

In the analyzed texts there is not a strict differentiation between useful plants in orchards and decorative in gardens. Andalusí agricultural treatises gather, in the same way as poets in *nawḍīyyāt* and *nawriyyāt* not only those species planted in gardens because of their beauty, ornamental qualities or their role in the garden architecture, but also those species useful and valuable for men as “home” plants (aromatic, medicinal, culinary, magical, repellents), thus combining both the ideas of ornamentation and usefulness, which make them inseparable.

Consequently, the following question arises: which plants are considered “ornamental” in these agricultural texts? Several key ideas can be useful to delimit these species cultivated in *bustān* and *jannā*, the two landscaped spaces mentioned in agricultural treatises.¹⁰

The agronomist Ibn Luyūn provides one of the most clear and eloquent definitions of this group of plants within the systematic classification of his work, where he follows the patterns established by al-Ṭighnārī centuries before. After the chapters related to “alimentary seeds” (vegetables and spices), he includes a section devoted to those plants “planted for recreation.” This text will be analyzed in detail, since it contains some very interesting explanations. He uses the participle of the Arabic word *maslāyāt* to define these plants, which means “something provoking distraction, amusement,” or “something producing calm and peacefulness.” This definition implies that these plants lack productive or material use, thus denying other uses not aiming at senses’ delight, and mainly, spiritual enjoyment. To reaffirm this concept, Ibn Luyūn adds: “numerous plants are cultivated for the delight (*tasliya*) of sight and smell, or to be used as ornamentation (*li-l-zīna*),”¹ being the best known (or highlighting, *ashhar*) those cultivated in orchards (*basātīn*).”

In this reaffirmation of the personal concept of al-Ṭighnārī and Ibn Luyūn, there is an interesting new element: the planting of these species is carried out in *basātīn* (plural of *bustān*), that is, in suburban domestic gardens. This fact confirms the use of a small area of these *basātīn* for clearly ludic purposes, devoted to their dwellers’ enjoyment. In this particular kind of orchard there are plants cultivated not only for economical or useful purposes, but also, or uniquely, for aesthetic or leisure delight.

The useful/ornamental dualism is not found in other agronomists’ treatises, where the classification of species is established according to standards of morphological similarity between them.

Apart from this direct and specific type of classification which facilitates the interpretation of the concept "ornamental," the rest of Andalusí agronomists point to the aromatic condition as one of the most common morphological characteristics. The color and shape of flowers are other characteristics mentioned by Andalusí authors as distinctive elements, usually together with their aromatic qualities. This shows that the main aim of these gardens is to pleasure two of the senses, sight and smell.

Within the group of tree species, some of them can be directly identified by the specific use mentioned, or by their location in the orchard or lands. They can also be identified by their shading quality, aroma, timber and fruits, a clear example of a group of trees with "multiple use."

Species of Ornamental Use

This section compiles those species clearly referred to as ornamental in source texts. Paragraphs related to this ornamental use are written in italics, followed by the author's name abbreviation, and brief comments about the species itself. Each entry is headed by the Arabic name (or names) of the species, followed by its Latin scientific name and its respective popular name. Note that this catalog is only an advance, an open list where more information can be incorporated and contrasted with other agricultural and botanical sources in order to make it richer.

GYMNOSPERMS

Pinaceae

Sanawbar (Pinus pinea, stone pine).

It is planted next to orchard (basātīn) walls in order to beautify them, since it is a high tree (IW). If planted in the middle of a pool or pond, it causes delight with its beauty and shade (IA). It must be transplanted from the mountains in January, when it has many roots (IA). When branches grow, they must be set upright each spring, so that its crown becomes pyramidal, similar to its pine cones (IA).

Its old ornamental use and cultivation, and mainly its edible kernels, make it very abundant in the wild, no doubt from autochthonous areas. During the Roman Empire, they were much esteemed and profusely cultivated. Probably, *Pinus halepensis* (Aleppo pine) was also used at this time.

Cupressaceae

Sarw, sarwal (Cupressus sempervirens, cypress).

It is planted surrounding orchard (basātīn) walls in order to beautify them, since it is a high tree (IW). It is also planted next to the orchard gate and the pond, and in the paths and angles (IA).

As in the previous case, the quoted paragraph gives an idea of cypress uses, preferably planted in rows (forming parades and roads within the garden), as well as for the decoration of walls. They are still used in this way in current Mediterranean gardening.

Taxaceae

Ṭakhsh (Taxus baccata, yew).

Its seedlings are brought from the mountains at the beginning of February, and they are planted in holes three spans deep. It is advisable to use rough and mountainous soil (AKh).

Probably its ornamental use justifies its transplanting and attempt of domestication in orchards or gardens.

ANGIOSPERMS MONOCOTYLEDONOUS

Araceae

Qulqās, qulqāṣ (Colocasia esculenta, taro).

Its planting is similar to the banana tree, and its roots are transplanted to orchards only due to its beauty and rare

configuration. It is planted next to water flows and in sunny places sheltered from the wind (AKh). It is used in orchards because of its beautiful appearance, its large leaves and its strange way of growing (UM).

Similar to other species introduced during the Andalusí period, it seems that the main reason for its use in orchards and gardens is the singularity of their bearing.

Liliaceae

Sawsan, *sawsān* (*Lilium candidum*, lilies).

This is a recreation plant, one of these cultivated for the delight of the sight and the smell, or for decoration (IL). It is planted in those areas of the orchards where no labour is made, and next to the ponds or pools (AKh, IA). It is planted in gardens and houses because of its beauty (UM).

Other textual sources, especially poetic, confirm its ornamental use.

Khayzarān (*Ruscus aculeatus*, butcher's broom).

It is moved from the woods to the orchards because of its beauty (IA).

Once again, the constant experience of domestication of wild species appears here. Wild specimens are transplanted from their natural populations to the orchard.

Iridaceae

Za 'farān (*Crocus sativus*, saffron).

This wild plant can be cultivated in orchards by means of its bulbs (IB).

Its strictly ornamental use is uncertain, although it is well esteemed in the orchard because of its aromatic properties.

Sawsan aḥmar (*Gladiolus* sp., gladioli); *sawsan asmarjūnī* (*Iris* sp., irises).

Aside from its constant comparison to lilies, no reference to this plant's ornamental use is found among agronomists in chapters especially devoted to "ornamental plants." (AKh, IA). Above all, they insist on the wild nature of these species, and on the medicinal virtues of some of them. However, they must be included within the list of garden species, since they are often quoted in poetical sources.

Amarilidaceae

Narjis (*Narcissus* sp. narcissus); *narjis aṣfar*, *nisrīn* (*N. jonquilla*, *N. serotinus*, yellow narcissus), *narjis abyāḍ*; *bahār* (*N. papyraceus*, *N. tazetta*, white narcissus), *N. poeticus* (*narjis qādūsi*), *narjis buwāqī* (*N. pseudonarcissus*, daffodil).

Among all the species identified in agricultural texts and the 'Umda, only some are considered ornamental. Others are referred to as wild species growing in prairies and other habitats. These are the comments found:

Bulbs of yellow and white narcissus are planted exactly in the same way (AA). The bulbs are planted in September, and they grow in December and January (IH, IA). Bulbs are extracted from prairies and planted in seedbeds. In May or June, follow the same steps as for the cultivation of lilies (IB, IA). Yellow narcissus is cultivated for the delight of the sight and smell, and as an ornamental plant in gardens (*basātīn*) (IL). If you want to get open and double narcissus, you must slash a bulb and introduce an unpeeled clove of garlic into the gash before planting it. If you want them to have a sweet smell and white and green leaves, put a green and fresh clove of garlic in the gash of the bulb, and plant it in a cool and humid place. You will get green doubled narcissus as those seen in Damascus (IA).

Palmaeae

Nakhl (*Phoenix datilifera*, date palm).

Date palms were probably considered cosmic trees in Andalusí agricultural culture, or at least, in Arabic culture.

Observations and comments of agronomists and botanists prove the deep knowledge about crop techniques, ecology, propagation and reproduction that this culture possessed. From the point of view of their usefulness, these trees offer not only dates, eaten in various ways, but also fibers and material for craft works and construction. It is definitely the arboreal reference of a whole culture and way of life. It is remembered and yearned for, so that its introduction in the Andalusí landscape, where it was foreign, was inexorable. These reasons show its important role in Andalusí gardening, although there are not many explicit paragraphs about its ornamental use (Fig. 2). However, a good example of the clear admiration for this tree is the following paragraph:

A palm tree is similar to a person in many aspects, especially in fecundation and reproduction, and in the correspondence between diverse parts of the tree and the body organs. They also coincide in some alimentary elements necessary for both (salt, for example) (TG). The person who plants a palm tree must have high moral qualities (IA). This is a very representative and worshiped tree in the Islamic Tradition (IA).

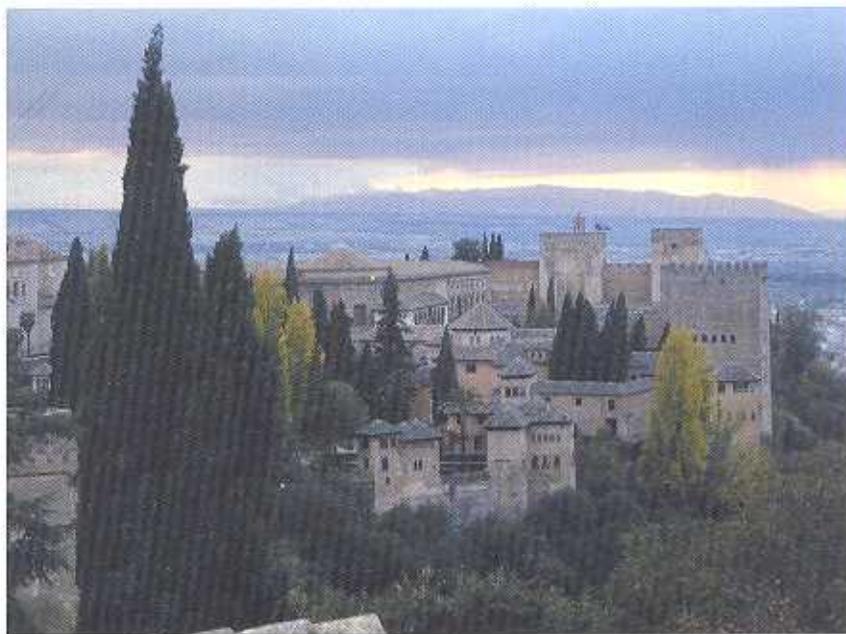


Fig. 2. Cypresses and date palms in the Alhambra seen from the Generalife. (Granada, Spain). (Photo by J. E. Hernández).

ANGIOSPERMS DICOTYLEDONOUS

Laureaceae

Rand, ghār (Laurus nobilis, laurel).

Trees with nice aromas and aromatic plants make it graceful (IA).

This is an indirect reference but it is enough for describing the use of laurel trees in gardens.

Berberidaceae

Barbārīs, bārbaris (Berberis vulgaris, barberry).

It is planted in the orchard corners (AKh).

This plant was mainly used as a dyer. In this sense, many old cultures (even American Indian: *Hematoxylon* sp., *Caesalpinia* sp., etc.) also planted spiny species with dyeing uses in gardens hedges and lands boundaries.

Nymphaeaceae

Nīlūfar (Nymphaea sp.); nīlūfar, n. abyad (Nymphaea alba, white water lily), nīlūfar asfar (Nuphar luteum, yellow water lily), nīlūfar aḥmar (Nelumbo nucifera, sacred water lily, lotus).

IA seems to refer mainly to the species *Nymphaea alba* (*nīlūfar abyad*), although he recognizes the existence of yellow and red water lilies. AA also mentions a white lily correctly differentiated by its phenology, dating its blooming in April. The UM's text mentions this species as typical of orchards and gardens (Fig. 3).

Concerning the yellow water lily (*Nuphar luteum*), IA refers to it indirectly, without differentiating it from the others apart from its yellow color. AA does distinguish it: *the flower we (Andalusí agronomists) call nīlūfar is different from the*



Fig. 3. Water lilies and myrtles in a pool located opposite the Northern Portico of the Casa del Chapiz, a Moorish building from the sixteenth century, nowadays hosting the Escuela de Estudios Árabes CSIC. (Photo by E. García).

one used by physicians. It is yellow and grows in the water. AKh's references to lilies, calling them *nīlūfar aḥmar*, *n. aṣfar*, *n. abyad* (that is, red, yellow and white), are more confusing.

Finally, through text analysis, sacred lily (*Nelumbo nucifera*) could possibly be identified, as they talk about purple flowers and Asiatic origin (India and China), and it was considered a sacred plant. This species is clearly mentioned in one of UM's paragraphs, where it is written: *another variety of nīlūfar is the so called Sicilian, or solar, which has red flowers. It grows in Egypt, Alexandria and Iraq. Its leaves are similar to the ones of yellow nīlūfar, which extend on the surface of stagnant waters, but it is more yellow...; it opens at day and closes at night, and it has an extraordinary aroma.* There are other species of *Nymphaea* known, with purple, pink and red flowers, such as *N. rubra*, *N. gigantea*, *N. colorata*, with Eastern Asiatic origin, but there is not enough data to confirm that they were known in al-Andalus.

Malvaceae

Khubbāzā, *mulūkhīyā* (*Malva* sp., *Lavatera* sp., mallows); *khiṭmī* (*Alcea rosea*, hollyhock).

Its identification is complex, and even more the distinction between mallows and marsh mallows. The UM quotes several varieties sometimes associated to local names (Cordoban mallow, Sicilian mallow). In the same text, he includes them in the group of plants cultivated in gardens and houses. The diversity of wild *malvaceae* with ornamental qualities makes the problem more complicated. This can be deduced through texts such as: *two or three seeds are planted together next to water flows, and they are tapped with sand. The planting takes place in September* (IA, IL referring to *Alcea*). *It blooms in May, when it is pulled up, or in January. The planting is done in the same way as the ornamental rose* (AKh referring to marsh mallow).

Ward al-zīna (*Hibiscus rosa-sinensis*, ornamental rose, lipstick).

This is a stout shrub with two species (according to the Nabataean Agriculture): one of them has big red flowers, and the other has small white flowers (IW). *This plant beautifies the orchard, and it is planted next to water flows* (AKh). *It is said that it is called ornamental rose because of its beauty, and also called rose of harlots, because these women use it to dye their hair* (IA). *It is so called because it is planted with ornamental purposes... It is also called rose of harlots because they use it in their works as a magical element* (UM).

These are probably the first testimonies of the use and introduction of this species in Western Mediterranean. This Asiatic plant has in fact dyeing applications.

Ulmaceae

Mays (*Celtis australis*, hackberry tree).

It is planted outside gardens, in the surroundings, and very close to one another (AKh). *As it is a shady tree, it is planted by the*



Fig. 4. Hackberry tree, representative of Andalusí gardens valued for its shape, sombre and fruit, and also for its turnable and water resistant timber. (Composition by E. Moreno, Botanic Garden of Córdoba, Spain).

garden walls, facing North and in humid places exposed to the morning dew (IA). It is a fruit tree planted in orchards because of its useful timber (IL).

These trees were most likely already used in the Iberian Peninsula in the past, possibly in Roman gardening. It was considered a very valuable tree because of its timber, fruit and shade (Fig. 4).

Nasham (*Ulmus minor*, elm).

It is planted next to wells, "zafareche,"²² irrigation channels and other humid places (AKh, IA); in the garden walls facing North and next to the entrance, so that the shade they cast does not harm fruit trees or vegetables, as well as in spacious and humid parts of the garden (IA).

Its values and uses are similar to those of the *mays*. IA refers to its ornamental use, far from the more productive areas of the orchard.

Salicaceae

Saṣṣāf, *gharab*, *sālij*, *khilāf* (*Salix alba*, willow).

It is planted next to the garden walls (IW, IA), facing North and by the entrance, so that the shade it casts does not harm fruit trees and vegetables, and also next to the well and the *zafareche* (IA).

Willows share the same selected use of the two species mentioned above.

Violaceae

Banaṣṣaj (*Viola* sp.; *V. tricolor*, *V. odorata*, *V. riviniana*, *V. reichenbanchiana*, violets, pansies).

There are two species, the wild and the ones cultivated in gardens.

They are transplanted into shady seedbeds at the beginning of November, so that they are available during the whole agricultural year (IB). They are planted in March, preferably in shady places among fruit trees. Dirty water must be avoided for their watering, because it will kill them. They are usually purple but can also be yellowish (IL).

Their medicinal properties justify their cultivation in gardens below fruit trees, as the UM shows, what was previously confirmed by Dioscorides and Isidoro de Sevilla. Andalusí agronomists' quotes clearly suggest their ornamental use in gardens. They are given special attention in poetic texts dealing with flowers (*nawriyyāt*).

Caparidaceae

Kabar, *kabbār* (*Capparis ovata*, *C. spinosa*, caper bush).

They were evidently cultivated and exploited because of their floral bud (capers) and unripe fruits, and probably grown as a climber species, which was allowed to cover walls and gates. IA includes it in a chapter titled "The sowing of plants usually grown in gardens and offering several aspects to the sight." This use is also testified in the wild presence of these species in archaeological enclaves.

Cruciferae

Khayrī (*Erysimum cheiri*, wallflower, *Mathiola incana*, stocks; others: *Mathiola* spp., *Malcolomia littorea*, *Hesperis laciniata*).

There are eight types: yellow, white and purple; the rest of them combine these colours and are very bright and colourful (IL). There are seven different varieties: wild and cultivated, and others classified by their colours: with white flowers, yellow flowers and red

flowers. The yellow wallflower is the one planted in orchards, which also has two varieties: one of them with yellow-golden flowers, and an unflowered one; both species are well known and people grow them in houses and orchards. Another horticultural variety has bright purple flowers. Another variety is speckled (UM).

Almost all the authors mention them (CC, AA, IH, IB, IA, IL), and they agree on the number of species, which are probably simple varieties of the two more important ones: *Erysimum cheiri* and *Mathiola incana*. Thanks to IA, and much more to UM, the complexity of what is called a wallflower is understood, as they gather another genus of cultivated species apart from the two mentioned above, also adding several wild species from the genera *Mathiola* and *Malcolmia*. The term wallflower can even include genera not belonging to the family of *Cruciferae*, as illustrated below.

Ericaceae

Janà aḥmar, maṭrūniya (*Arbutus unedo*, strawberry tree, arbutus).

Young and sprouting strawberry trees are transplanted from the mountains to the orchards with their roots and root balls in January. They must be frequently watered until they take root. The best way to do it is transplanting the wild tree with some leaves in autumn (IA). Its leaves will be greener and more beautiful if it is planted in humid parts of the garden (AKh).

The mentioned extraction of young plants from the mountains can serve as a demonstration of their difficult and slow propagation on one hand, and of the common use of wild plants for gardens on the other. In the Andalusi period, this practice was a way of enriching orchards and gardens, a process that represents the first phase of domestication.

Rosaceae

Za 'rūr (*Crataegus azarolus*, azarole).

The azarole, similar to the bramble and other elements, is used to make defensive hedges for vineyards and gardens (IA).

The use of this species for thorny hedges is interesting and valuable, because, although it could be referred to as *C. monogyna* or other species of *Rosaceae*, it proves the existence of a specific landscape with boundaries and hedges. In spite of the distribution and abundance of hawthorn in the Iberian Peninsula, there is always a doubt that this comment comes from far Eastern sources.

Mushtahā (*Sorbus aria*, whitebeam); ghubayrā' (*S. domestica*, whitty pear).

It is placed next to pools due to its beauty (IA referring to *Sorbus aria*). It is planted next to pools because of its elegance and the beauty of its flowers (IA from TG, referring to *Sorbus domestica*).

Although both species are mentioned in other Andalusi texts in the tenth century (CC), they are not alluded to as ornamental species in an explicit way. However, IA's brief comments include at least one important quote when referring to its flowers and beauty as a reason for planting them in gardens.

Ḥabb al-mulūk, qarāṣiyā (*Prunus avium*, cherry tree), ijjās, 'uyūn al-baqar (*P. domestica*, plum tree), maḥlab (*P. mahaleb*, mahaleb cherry).

It is obtained from wild young plants, although these are bad arboreous genera not comparable to the cultivated ones (TG). The planting must be implemented very carefully, pulling out the plant with all its roots, and no iron tool touching them (TG). In order to obtain a cherry tree with a rare shape, it must be planted in inverse position (TG, IA). They are taken from the wild to the orchards in November (TG), from young plants in January or February (IA), when they are planted in deep holes with a basis of sand (TG).

There is no explicit mention of the cultivation of these trees in gardens, nor a significant comment about its flowers, crown or bearing. As for the cherry tree, the sentences above at least give evidence of the effort to cultivate wild plants and the presence of wild populations in gardens.



Fig. 5. Jardín Alto in the archaeological site of Madīnat al-Zahrā' (Córdoba, Spain). These are "invented" gardens, being their species design and composition are rather unfounded. Remains of *atauriques* (decorative stone panel) can be seen on the floor. (Photo by J. E. Hernández).

Ward (*Rosa* sp., roses, mainly *Rosa canina*, *R. gallica*, *R. sempervirens*, *R. damascaena*).

These are ornamental plants cultivated for the delight of sight and smell (II. 263). They must be planted by both sides of the orchard (TG, IA) and in *parades* (TG). Roses are located adhered to pavilions of some buildings (II). Branches of the variety of doubled roses are wider than those of the wild rose (TG). Recently planted roses must be watered often so that they grow strong, but they will bloom later (IB). The first flowers appear in March (CC), although they are more abundant in April (IH, IA). For roses to bloom twice a year, in spring and autumn, they must not be watered during hot periods, and be often and abundantly watered in August (IB, AKh).

The use of roses is unquestionably illustrated in the selected paragraphs, even the uses of multiple flowered roses and other varieties of diverse bearing and phenology.

Rhamnaceae

'Unnāb, *zufayzaf*, *zifzif* (*Ziziphus jujuba*, jujube); *nabq* (*Ziziphus lotus*, lotus tree).

They are planted in corners and not very busy places of the garden, because they tear the clothes when passing by too close (AKh referring to *Z. jujuba*). They do not need manure when planted in orchards (IA referring to *Z. lotus*).

Aside from IA, the rest of Andalusī agronomists clearly distinguish between the jujube, and allochthonous arboreous species used because of its fruit, and the lotus, a bushy species. The use of the *nabq* to form hedges is evidenced even now in the surroundings of Madīnat al-Zahrā', which proves that *Ziziphus lotus* was very well known by the authors (Fig. 5).

Vitaceae

Karm, *dāliya* (*Vitis vinifera*, vine, grapevine).

Trees with few roots can be placed among vines, such as pomegranates, apple, quince or even olive trees. On the contrary, fig trees must not be planted among vines (IA, II). Climbing vines are leaned on plum trees to make it more productive (AA). Vines hanging from elms are very beautiful (AKh).

The information provided by Andalusī agricultural treatises offers a perspective that considers vine an intensive crop, which follows the same management of pruning, watering and exploitation than other fruit trees. Vines were even cultivated among them, probably in small house gardens instead of in large monoculture lands. An important testimony of the ornamental use of vines is the abundant and detailed descriptions and instructions to make vine arbours and the way they were disposed of in orchards.

Caesalpinaceae

Dhādī (*Cercis siliquastrum*, Judas tree or Love tree).

This is a very beautiful tree with abundant substance and soft wood, nice coloured flowers lasting more than 20 days, and

whose fruits are not edible (AKh). It is a well-known tree because of its reddish and big flowers; its fruits are not edible, thus it is planted for ornamentation (IA). Its cuttings are planted at the beginning of March, among irrigation channels, tanks and wells, and they are transplanted in February of their second year (AKh). It blooms in May (AKh).

The UM describes *dhādī* in a very reliable and secure way, as it offers detailed information about its phenology, flowers and fruit, blackish wood, general physiognomy and use in gardening. It was quoted by Teofrasto, but not by late authors such as Plinio, Columela, Casiano Baso or Isidoro de Sevilla. Most of the Andalusi agronomists do not mention this species apart from AKh and IA, but it is perfectly described in the UM. As a consequence of this multiple use and cultivation in the al-Andalus garden, we have the impression that this species probably spread quickly, in spite of being a great innovation. In the sixteenth century, Clusius (Ramón-Laca et al. 2004) said that the Moorish of Granada, derived from its Arab name, called it “*dīt*.” UM also stated its exoticism and oriental origin, something that was also mentioned by agronomists, and onto which species it may be grafted. These references seem to be exclusively extracted from Nabataean Agriculture, since only oriental species are mentioned.

Meliaceae

Azādarkhat (*Melia azederach*, China berrytree).

This beautiful tree smells very well in the morning and the afternoon (IB). This tree is usually planted in our regions [al-Andalus] (IA). It is an ornamental tree growing in orchards, where it is planted next to the well and the *zafareche*, in order to cool the water with its shade (IA) and to make vine arbours on its branches, to keep ploughing tools and straps for waterwheel animals under their shade (IA). It is planted in pots around the houses (AKh).

This tree was undoubtedly much appreciated for its beauty. It was planted next to the well and the *zafareche* probably because these were places devoted to resting, where the shade and beauty of the trees could be better noticed. It seems that Greek, Roman or Visigothic authors did not mention this species before. The first mention of this species by Andalusi agronomists took place at the end of the eleventh century by Abū l-Khayr, and later by Ibn al-'Awwām in the twelfth century. Consequently, this species was probably introduced during the Islamic period. Alonso de Herrera knew these “paradises” in the sixteenth century, and he differentiated them from those of *Elaeagnus angustifolia* (Carabaza et al. 2004, 233).

Rutaceae

Utrujj (*Citrus medica*, citron); *nāranj* (*C. aurantium*, sour orange tree); *līm*, *laymūn* (*C. limetta*, *C. aurantifolia*, *C. limon*, lime tree/lemon tree); *zambū*, *istinbūnī* (*Citrus grandis*, grapefruit tree).

It (*utrujj*) is planted at the beginning of autumn or spring, in warm places exposed to the southern wing and sheltered from north winds by the garden walls (IA). Orange trees (*nāranj*) are placed in the middle of a pool or pond pretending to be planted in the water (IA). Lemon trees (*laymūn*) are planted next to the walls to shelter them from north winds. Grapefruit trees (*zambū*) are transplanted with their own soil when they are two or more years old, from September to the end of January, next to the walls to shelter them from the “*cierzo*” (Northern wind), separated at least six cubits, otherwise they do not produce enough fruits (IA).

It is very interesting to study the progressive introduction of citrus trees, the citron being the first to reach the Iberian Peninsula after a long travel from Asia, way before the Andalusi period. Afterwards, lemon, lime and grapefruit arrived. Palynological studies confirm the presence of citrus trees in Nasrid gardens (thirteenth-fifteenth century) (Casares et al. 2003).

Myrtaceae

Rayhān, *ās* (*Myrtus communis*, myrtle).

It is planted next to the orchard gate or to the *zafareche* because it is an ornamental plant (IA) (IL), and also surrounding the pavilion (*qubba*) in gardens (IL). There exist several procedures for planting myrtle inside pools (IA). It should not be pruned, as its



Fig. 6. Arborescent myrtle with the Alhambra at the bottom (Granada, Spain). (Photo by E. García).

although he diminishes its importance: *it is not very common in al-Andalus where it is planted only in certain places.*

Punicaceae

Rummān, jullanār (Punica granatum, pomegranate).

Wild pomegranate (jullanār) has no fruits, because its blooms but its flowers fall (TG, IA); its leaves are similar to those of the cultivated pomegranate, although they are darker and its flowers are thicker and more beautiful (TG, IA), some white and some pink (IA). Wild pomegranate (jullanār) grows from inverted cuttings of cultivated pomegranate. These cuttings are planted and pulled up the following year, repeating the pulling every year until the fifth one. By then, it becomes a higher tree with flowers bigger than pomegranate's (TG, IA). In orchards, wild pomegranates are planted near the well and the zafareche (IA).

Agronomists mention plenty of varieties, some of whose uses are very similar to current ones, such as their ornamental quality and their use for hedges. An outstanding point is the transplanting of wild pomegranate, which probably comes from *Nabataean Agriculture*, because there are no autochthonous or wild populations of pomegranates. In any case, this technique seems to address not only the use of these species as a pattern for other species grafts, but also with an ornamental purpose, due to the admiration for its flowers.

Onagraceae

Khayrī al-mā' (Epilobium sp.: E. hirsutum, E. angustifolium, fireweed or willow herb).

Another variety is the water wallflower, which has two species: small and big. The first one extends over the ground, and has thin leaves.... The big one has purple, thin and prominent flowers. It has a sour taste and its root is similar to a carrot, with many filaments. It grows by river banks and sources.

The species of *Epilobium* are effectively typical of river banks, with purple-violet flowers similar to wallflowers. They are hardly mentioned in agricultural texts, except for AI and UM. It was possible to identify this taxon as *Epilobium*, probably *E. angustifolium* or *E. hirsutum*, thanks to the precision of UM, by interpreting both the morphological and ecological aspects.

beauty lies in its wildness (IA). The mountain myrtle must not be planted in houses or orchards because it brings misfortune (IA).

Ornamental uses are insistently alluded to, in addition to other peculiar applications. It is interesting that IA mentions avoiding pruning, in agreement with current environmental criteria defending the wild and natural shapes in gardens (Fig. 6).

Lythraceae

Ḥinnā' (Lawsonia inermis, henna plant).

It is planted for ornamentation (IL).

Some authors (IB, AKh, TG, IA, IL) offered a very precise description of henna plant, which leads us to think that it was cultivated in al-Andalus, but later abandoned. IB's comment clearly mentions its cultivation,

Elaeagnaceae

Allohanta (*Elaeagnus angustifolia oleaster*).

This is a very beautiful tree, with many branches and beautiful scented flowers (IB). The best place to plant them is surrounding wells or pools (IB).

Oleaster is an eastern Mediterranean species economically interesting as ornamental, because of its colorful white-silver foliage. It has been used as a dyer and it is known because of its aroma and edible fruit. However, it has bad quality wood. IB's quote is probably the first mention of *Elaeagnus angustifolia* in occidental bibliography (Carabaza *et al.* 2004, 289). Ancient authors such as Plinio, Columela, Casiano Baso and Isidoro de Sevilla did not mention it. However, immediately after the Andalusi period, Alfonso de Herrera did mention this species. Many problems arise when trying to identify this tree species, at a philological level. The Spanish term "allohanta" comes from a text of Millás Vallicrosa, who edited an old translation (dated at the end of the thirteenth or beginning of the fourteenth century) of the Ibn Baṣṣāl's treatise in medieval Spanish, since the original Arabic text has not been found (Millás Vallicrosa 1948). Instead, morphological and crop data make possible a quite reliable identification of the species.

Araliaceae

Qissūs (*Hedera helix*, ivy).

It is used for covering reed lattices to shade the plants beneath them (AKh). It is a wild plant, which climbs to trees and hangs down from their branches; reed lattices are made for them to climb (IA).

When writing about *qissūs*, IA alludes to its Romance name, *yidhra*, differentiating it from another climbing plant with bell-shaped beautiful flowers (probably *Calystegia sepium*). In any case, AKh's and IA's comments are very interesting, as they mention shading structures used in orchards and gardens, thus proving the existence of well defined architecture, design and garden furniture.

Apocynaceae

Diflā (*Nerium oleander*, oleander).

They are transplanted from the wild, using a kind of soil similar to the one they grow in nature (AKh); ... common and 'royal' oleanders are cultivated in gardens for ornamentation (IL). Regarding different varieties of this plant, authors refer to its flower's colour: one has red flowers; another one, less abundant and whose flowers are white and whose wood is greyish, is sterile (IA). There is another variety called 'royal oleander' (*diflā mulūkīyya*) (IL).

Oleander is a riverside plant which can reach tree bearing. Its flowers are red or white and it is almost exclusively cultivated because of its ornamental value. As a poisonous plant, it has other occasional applications. Several Andalusi agronomists mention the ornamental value of this species, which proves that it was very commonly used for this purpose in this period. Prior to the Andalusi period, other authors such as Casiano Baso wrote about the oleander repellent qualities, but not about its ornamental uses (Fig. 7). It is worth highlighting the reference to different varieties according to flower color and multiplicity, probably distinguishing what they called "royal oleander."

Ḥabl al-masākīn, binka (*Vinca pervinca*, *V. difformis*, *V. minor*, creeping myrtle).

This species could be identified through a description included in the UM: it is a variety of *qissūs* (*Hedera elix*, ivy), a creeping plant with "myrtaceous" aspect (leaf shape and disposition are similar to myrtle's). Three or four branches come out of its roots, and its flowers are blue. It adds that its name means "poor people's rope" because it is used to tie herbs and vegetables when collected. It is planted in orchards and gardens. There is also in the UM a geographical reference regarding its name and use in Cordoba (nowadays it still grows wild in the south of the province). IA devoted a chapter to the way how *binka*, *yidhra* (ivy), dill and fumitory are sowed... this plant can be plaited, has nice flowers and is a variety of *yidhra* (ivy)... they are both transplanted from the mountains in February, pulling them up with their roots.



Fig. 7. Oleander (*Nerium oleander*). This is an Iberian and Mediterranean autochthonous species used as an ornamental plant in Andalusian gardens, in spite of its toxicity. (Photo by J. E. Hernández).

Apart from its ornamental quality, its use in rope-making is also very interesting, as this utility seems to have disappeared. This genus is still very useful in gardening as ground-cover and for medicinal properties.

Oleaceae

Yāsāmīn, *yasmīn* (*Jasminum officinale*, *J. sambac*, white jasmine); *yāsāmīn aṣḥar* (*Jasminum nudiflorum*, yellow jasmine); *zayyān* (*Jasminum fruticans*, wild jasmine).

This plant is used for ornamentation (IB), placed near the gate and the *zafareche* (IA), climbing on a small arbour to make it more beautiful and attractive (TG). It is also planted near watering channels, tied to wooden fences or reed lattices (IA). It has white and yellow flowers (IH, AKh, TG, IA) and comes from Iraq (IL). The yellow flower variety is not aromatic, although its smell is similar to the “jabí apple”.¹³ Both species, together with those of dark blue and purple flowers, are orchard plants (IA).

Crop techniques referred to are not enough to establish which species were known in al-Andalus, since the descriptions are suitable to the whole genus. The quote regarding the possibility of grafting a yellow jasmine and a white one, makes clear that apart from the wild jasmine (*J. fruticans*), they knew of at least a white flower climbing jasmine, mainly used for ornamentation, probably *J. officinale*. However, it could also be the ‘royal jasmine’ (*J. grandiflorum*), more appreciated than the previous one because it is used for perfume making, instead of being purely ornamental. “Royal jasmine” comes from India, and is considered by some authors a vigorous variety of white jasmine, *J. officinale* f. *grandiflorum* (López González 1982).

Labiatae

There is no clear evidence regarding the ornamental use of the many species of this family, although Andalusian agronomists and botanists have great experience in their cultivation and aromatic uses. How far were these species used in gardens and orchards? Those species they mentioned are gathered in this work, as they were considered ornamental elements in gardens. Rosemary (*Rosmarinus officinalis*), lavender (*Lavandula* sp.) and basil (*Ocimum basilicum*) have been identified, facing some difficulties. But other species of aromatic, ornamental and even medicinal interest—such as thyme, oregano, mint, lemon balm, sage, bugle, etc.—are difficult to establish a unique correspondence with concrete species of the genera *Thymus*, *Thymbra*, *Satureja*, *Origanum*, *Ocimum*, *Mentha* and *Melissa* among others. The following ones will be mentioned: *Khuzāma*, *ustūkhūdhūs* (*Lavandula* sp., *L. vera*, *L. latifolia*, *L. multifida*, lavender); *shīḥ qantūshku* (*Lavandula stoechas*).¹⁴

UM groups into the same term *shīḥ tammus*, tomentose (*hadabāt*) and aromatic species, “incenses” in general, thus including species of *Artemisia*, as well as other species associated with the genus *Lavandula*, which is denominated *ustūkhūdhūs*. Within this group, a cultivated high species can be found, and other shorter wild ones (*ustūkhūdhūs aqṣar*, *khuzāma*, such as *Lavandula vera*, *L. latifolia* and *L. multifida*). It also talks about a *shīḥ qantūshku* (*Lavandula stoechas*). Information about their aromatic and melliferous qualities are provided, but their ornamental use is not completely clear, although they were almost surely used for this purpose. Regarding *khuzāma*, IA declares: “...it is said that if you look at its flowers your spirit arises and senseless sadness disappears.”

iklāl al-jabal (*Rosmarinus officinalis*, rosemary).

Identifying rosemary has been a difficult task. The UM considers that it could be included into the genus of *tammus* (from the Greek *thamnos*, undershrubs) and hairy plants. "This species was called *libānūtīs* by Dioscorides. In *Rūmjyya*²⁸ it is called *rūmīrū* and *rūmarīnū* what means "Byzantine's (or Roman's) herb." This term clearly coming from the Latin word *rosmarinus*, which is the origin of the English term "rosemary." There is no direct reference to its ornamental use in the UM, being a text that normally does not refer to this use. In addition, there is no mention of this species in other authors' treatises. The following paragraph has been extracted from the UM: *it blooms in autumn or winter, and its flowers are bluish white. Its seeds are the same size as mustard's, thin and long, and they have white spots. Its taste is sour and astringent, but it is aromatic.* The crown is well identified as *Rosmarinus officinalis*, a peculiar phytonym, differentiating it from other crowns generally associated with various leguminous plants.

Habaq (*Ocimum basilicum*, basil).

There are many species with many different colours. Some of them are better than others because of their aroma and usefulness (AKh). *They are sowed from April to May, by burying small branches with buds* (IL). Agronomists distinguished up to thirty-three different species of basil, among which it is possible to find *Ocimum basilicum* (a great amount of its pollen has been found in the archaeo-palynological exploitation of the Caliphal city of Madīnat al-Zahrā') (Martín-Consuegra *et al.* 1995), but also species of other genera such as *Melissa*, *Mentha* and *Origanum*. IA mentions at least three species, one of them he calls "clove-like" (*qaranfulī*), probably because of its smell, similar to the clove.

Compositae

Bābūnaj, *uqḥuwān* (*Tanacetum*, *Anthemis*, *Artemisia*,..., camomiles, daisies...).

After consulting Andalusī agronomists and other authors such as Ibn al-Bayṭār or the 'Umda text, it has been concluded that two big groups of camomile exist, the so-called *bābūnaj* and *uqḥuwān* (Navarro García and Hernández Bermejo 1994). The first term, *ḥābūnaj*, is used to denote a group of several species whose aromatic and medicinal virtues have been proven, characterized by the color of their ligulate flowers (white, yellow or purple). These plants seem to correspond to species of the genera *Anthemis*, *Chamamemlum*, *Chamomilla*, *Chrysanthemum* and maybe *Anacyclus*. The second term, *uqḥuwān*, could be equivalent to the Greek *parthenio*, but could also correspond to other species of chrysanthemums or daisies (*Artemisia*, *Anacyclus*, *Chrysanthemum* and other genera). In any case, Ibn al-Bayṭār's mention is given: *there are two species, a mountainous one growing in very cold mountains, and a cultivated one growing in gardens and houses.* This text proves their ornamental use. Ibn Luyūn also mentions these species among the ornamental ones.

Conclusion

A comparative analysis of the species mentioned by some eleventh century authors reveals around sixteen species, a very low percentage out of the total amount in agricultural texts. This fact could indicate established stereotypes adopted by certain strata of Andalusī society, which try to imitate what comes from the Far East, instead of from their own social setting.

Although the objectives of agricultural and botanical texts are totally different from those of poems, they show plants growing in domestic gardens in a close and tangible way, and having a clear ornamental intention. The presence of some species with evident ornamental use in gardens, orchards and houses has been generally confirmed. It is worth commenting on the absence of certain species that have not been mentioned or could not be identified thus far. A good example is the carnation (*Dianthus* sp.), which, in spite of being of western Mediterranean origin and having its diversity center in the Iberian Peninsula, does not seem to be used as ornamental species until the fifteenth or sixteenth centuries, when introduced via Central Europe.

Isidoro de Sevilla mentioned other species presumably used as ornamental, whose absence must be due to their

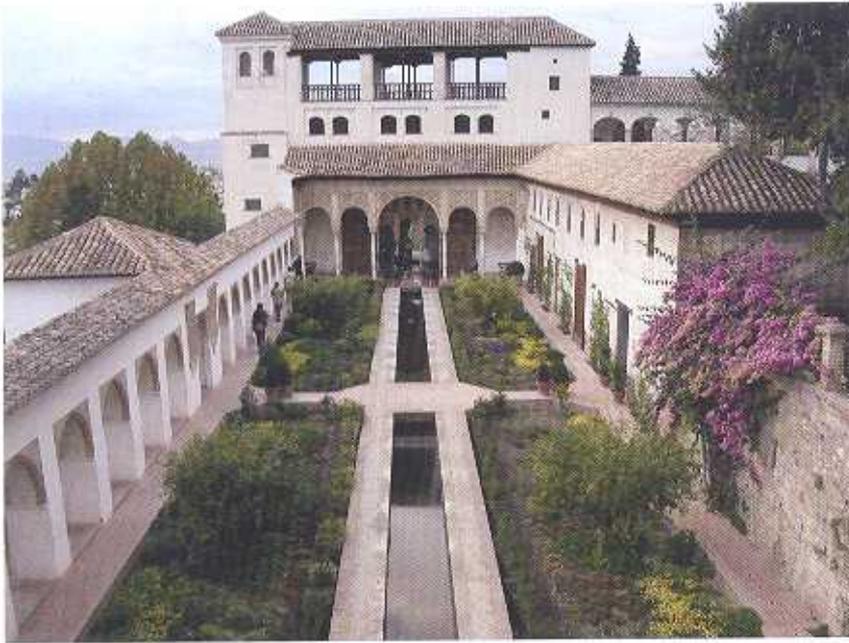


Fig. 8. Patio de la Acequia in the Generalife (Granada, Spain) after the last controversial intervention in the plant element (2004). *Bougainvillea* specimens can be seen on the walls. (Photo by J. E. Hernández).

are said “to be transplanted from the mountains to the gardens.” It is not known whether it was for ornamental use, but perhaps for use as a pattern for grafting other trees (maybe olive trees in the case of mastic tree). However, this agronomical domestication is confirmed by the *Pistacia* pollen found in the lower levels of medieval layers of the Patio de la Acequia (Fig. 8), which could correspond to autochthonous surrounding flora (Casares *et al.* 2003).

As previously mentioned, some *labiatae* are not totally identified: for example, thyme, sage, oregano, savory, etc.; while other important species such as *Phlomis* sp. are not even included.

In contradiction to pollen analysis in the Generalife Patio de la Acequia (M. Casares *et al.* 2003), there is no quote regarding grasses. *Acanthus mollis* use is not clearly established either, despite being a very well-known species used by sculptors, painters and architects from old Mediterranean cultures. In archaeo-pollen records of the Alhambra, *acanthus* does not appear before the seventeenth century, so was it rarely used as an ornamental plant? However, the same studies confirm the ornamental use of several citric trees and *Cupressaceae*, which are present in al-Andalus agricultural and botanical texts.

Finally, it must be clarified that several species of medicinal and aromatic *Apiaceae* and *Labiatae*, as well as other dying or “home” species listed by several authors (Ibn Luyūn for instance), are not included within this work, as they do not justify their ornamental uses. Others, such as Ibn al ‘Awwām, associate these species with those that are clearly ornamental, and they include them in an epigraph related to “plants to be close” (to the house, maybe in pots, patios or corners). These are useful and “immediate” plants such as parsley, celery, rue, sage, madder, cress, woad or rocket.

northern distribution—for example, the hop (*Humulus lupulus*). This work also excludes other species that were probably mentioned by physicians, botanists, poets or historians, including a clear reference to their ornamental use. An example is *Viburnum tinus*, which must be mentioned in the UM. Besides being a wild species in al-Andalus, it is mentioned as an ornamental plant by authors such as Clusius in the sixteenth century. *Ficus sycomorus* has also not been included, as there is not enough evidence to prove that it was used at that time. The same is true for *Ricinus communis*, although it was probably planted in gardens.

Another surprising omission is *Platanus orientalis*, whose ornamental use is not referred to, in spite of being very commonly used in Roman gardening throughout the Mediterranean regions, especially in the Iberian Peninsula. Something similar occurs with *Pistacia lentiscus* and other species that

Bibliography

Sources

Abū l-Khayr al-Ishbīlī. *Kitāb 'Umdat al-tabīb fī ma'rifat al-nabāt li-kull labīb* (Medical support for the knowledge of plants by all experts). Edited by Joaquín Bustamante, Federico Corriente, and Mohamed Tilmatine. Vol. 30 of *Fuentes Árabe-Hispanas*. Madrid: CSIC, 2004. (UM).

Abū l-Khayr al-Ishbīlī. *Kitāb al-Filāḥa. Tratado de agricultura*. Edited and translated by Julia M. Carabaza Bravo. Madrid: ICMA, 1991. (AKh).

'Arīb b. Sa'īd, *Kitāb al-Anwā' (Le Calendrier de Cordoue)*. Edited and translated by Charles Pellat. Leiden: E. J. Brill, 1961. (CC).

Carabaza Bravo, Julia M. *Aḥmad b. Muḥammad b. Ḥajjāj al-Ishbīlī al-Muqni' fī l-filāḥa*. Introduction, study, and translation, with glossary (ed. microfiches). 2 vols. Granada: Universidad de Granada, 1988. (IH).

Casiano Baso. *Geopónica o extractos de agricultura de Casiano Baso*. Translated by M. José Meana, J. Ignacio Cubero, and Pedro Sáez. Madrid: Ministerio de Agricultura, Pesca y Alimentación, 1998.

Columela. *De los trabajos del campo*. Edited and translated by Antonio Holgado. Madrid: Siglo XXI and Ministerio de Agricultura, 1988.

Fahd, Toufiq, ed. *L'Agriculture Nabatéenne. Traduction en arabe attribuée à Abū Bakr Aḥmad b. 'Alī al-Kasdānī, connu sous le nom d'Ibn Waḥshīyya (IV/Xe siècle)*. 3 vols. Damas: Institut Français de Damas, 1993-1998.

Herrera, G. Alonso de. *Agricultura general*. Edited by Eloy Terrón. Madrid: Servicio de Publicaciones del Ministerio de Agricultura y Pesca, 1981.

Ibn al-'Awwām. *Kitāb al-filāḥa. Libro de agricultura*. Edited and translated by J. Antonio Banqueri. 2 vols. Madrid, 1802. (Ed. facs. with preliminary study and notes by J. Esteban Hernández Bermejo and Expiración García Sánchez), Madrid: Ministerio de Agricultura, 1988. (IA).

Ibn Bassāl. *Kitāb al-qaṣd wa-l-bayān. Libro de agricultura*. Edited and translated by José M. Millás Vallicrosa and Mohammed 'Azīmānī. Tetuán, 1955. (Ed. facs. with a preliminary study by Expiración García Sánchez and J. Esteban Hernández Bermejo). Sevilla: Sierra Nevada 95, 1995. (IB).

Ibn Luyūn. *Kitāb ibdā' al-malāḥa wa-inḥā' al-rajāḥa fī uṣūl sinā'at al-filāḥa, Tratado de agricultura*. Edited and translated by Joaquina Eguaras Ibáñez. Granada: Patronato de la Alhambra y Generalife, 1975. (IL).

Ibn Wāfid. *Tratado de agricultura: traducción castellana (Ms. s. XIV)*. Edited by Cipriano Cuadrado Romero. Málaga: Universidad de Málaga, 1997. (IW).

Isidoro de Sevilla. *Etimologías*. Edited and translated by José Oroz Reta and Manuel A. Marcos Casquero. 2 vols. Madrid: BAC, 1982.

López y López, Angel C., ed. and trans. *Kitāb fī tartīb awqāt al-ghirāsa wa-l-maghrūsāt. Un tratado agrícola andalusí anónimo*. Granada: CSIC, 1990. (AA).

Millás Vallicrosa, José M. "La traducción castellana del *Tratado de agricultura* de Ibn Baṣṣāl." *Al-Andalus* 13, no. 2 (1948): 347-430.

Al-Tighnārī. *Kitāb Zuhrat al-bustān wa-nazhat al-adhḥān. Esplendor del jardín y recreo de las mentes*. Edited by Expiración García Sánchez. Vol. 32 of *Fuentes Árabe-Hispanas*. Madrid: CSIC, 2006. (TG).

Studies

Carabaza Bravo, Julia M., Expiración García Sánchez, J. Esteban Hernández Bermejo, and Alfonso Jiménez Ramírez. *Árboles y arbustos de al-Andalus*. Madrid: CSIC, 2004.

Casares Porcel, Manuel, José Tito Rojo, and Osvaldo Socorro Abreu. "El jardín del Patio de la Acequia del Generalife. II. Consideraciones a partir del análisis palinológico." *Cuadernos de la Alhambra* 39 (2003): 87-107.

Dickie, James. "Notas sobre la jardinería árabe en la España musulmana." *Miscelánea de Estudios Árabes y Hebraicos* 14-15 (1965-1966): 75-87.

García Sánchez, Expiración. "Agriculture in Muslim Spain." In *The Legacy of Muslim Spain*, edited by Salma Kh. Jayyusi, 987-99. Leiden: E. J. Brill, 1994.

García Sánchez, Expiración. "Cultivos y espacios agrícolas irrigados en al-Andalus." In *Agricultura y regadío en Al-Andalus: síntesis y problemas*, edited by Lorenzo Cara Barrionuevo and Antonio Malpica Cuello, 17-37. Almería and Granada: Instituto de Estudios Almerienses, 1995.

Hernández Bermejo, J. Esteban. "Aproximación al estudio de las especies botánicas originariamente existentes en los jardines de Madīnat al-Zahrā'." *Cuadernos de Madīnat al-Zahrā'* 1 (1987): 61-80.

Hernández Bermejo, J. Esteban. "Dificultades en la identificación e interpretación de las especies vegetales citadas por los autores hispanoárabes. Aplicación a la obra de Ibn Baṣṣāl." In *Ciencias de la Naturaleza en al-Andalus. Textos y Estudios. 1*, edited by Expiración García Sánchez, 241-63. Granada: CSIC, 1990.

Hernández Bermejo, J. Esteban. "Botanical foundations for the restoration of Spanish-Arabic gardens: Study of the plant species used and their introduction during the Andalusí period." In *The Authentic Garden. A Symposium on Gardens*, edited by L. Tjon Sie Fat and Erik de Jong, 153-64. Leiden: Clusius Foundation, 1991.

Hernández Bermejo, J. Esteban, and Expiración García Sánchez. "Economic Botany and Ethnobotany in al-Andalus (Iberian Peninsula: Tenth-Fifteenth Centuries), an Unknown Heritage of Mankind." *Economic Botany* 52 (1998): 15-26.

Lane, E. William. *Arabic-English lexicon*. CD-ROM Edition. Vaduz: Thesaurus Islamicus Foundation, 2003.

López González, Ginés. *Guía de campo de los árboles y arbustos de la Península Ibérica y Baleares*. Madrid: INCAFO, 1982.

Martín-Consuegra, Enriqueta, J. Esteban Hernández Bermejo, and J. Luis Ubera. "Palinology of the Historical Period at the Madīnat al-Zahra Archaeological Site." *Journal of Archaeological Science* 23 (1995): 249-62.

M. Angeles Navarro García and J. Esteban Hernández Bermejo. "Las manzanillas en los autores andalusíes: algunos apuntes para la interpretación de los textos." In *Ciencias de la Naturaleza en al-Andalus. Textos y Estudios 3*, edited by Expiración García Sánchez, 143-58. Granada: CSIC, 1994.

Pérès, Henri. *Esplendor de al-Andalus: la poesía andaluza en árabe clásico en el siglo XI: sus aspectos generales, sus principales temas y su valor documental*. Translated by Mercedes García-Arenal. Madrid: Hiperión, 1983.

Ramón-Laca, Luis, Ramón Morales and Manuel Pardo de Santaljana. "Árboles y arbustos en obras agrícolas y botánicas del siglo XVI." In *Ciencias de la Naturaleza en al-Andalus. Textos y Estudios 7*, edited by Expiración García Sánchez and Camilo Álvarez de Morales, 207-59. Granada: CSIC, 2004.

Rubiera, M. Jesús. *La arquitectura en la literatura árabe*. Hiperión: Madrid, 1988.

Stoetzer, Willem. "Floral Poetry in Muslim Spain." In *The Authentic Garden. A Symposium on Gardens*, edited by L. Tjon Sie Fat and Erik de Jong, 177-86. Leiden: Clusius Foundation, 1991.

Tito Rojo, José. "Caratteristiche dei giardini ispano-musulmani." In *Giardini islamici: architettura, ecologia. Atti del Convegno Genova, 8-9 novembre 2001*, compiled by Matteini, Milena and Attilio Petruccioli, 27-58. Genova, 2001.

Watson, Andrew M. *Agricultural innovation in the early islamic world: the diffusion of crops and farming techniques, 700-1100*. Cambridge: University Press, 1983.

Notes

¹ This moment of agricultural development has been called "green revolution" by some authors (Watson 1983).

² An overall view of al-Andalus agriculture can be found in García Sánchez' work (1994).

³ Broadly speaking, this has been the same method used in the work *Árboles y arbustos de al-Andalus* (Carabaza et al. 2004). One of this work's novelties lies in its methodology, as there were no other previous works that include identification of species based on non-philological criteria.

⁴ Among other examples, this is the case of Rubiera's work (1988, 79-96), or successive versions of Dickie's article "Notas sobre la jardinería árabe en la España musulmana" (1965-1966).

⁵ Pérès (1983, 172, 191) agrees with this regarding *rawdīyyāt*, but he does not share the same opinion about the *nawriyyāt*, which he considers direct reflections of nature. This opinion has been refuted by Stoetzer (1991, 185).

⁶ *Almania* (Arabic *munya*) is a kind of country house in the periphery of Andalusí cities.

⁷ A pioneering work is Hernández's (1991), which demands a more rigorous use of species in garden restoration from an ornamental perspective.

⁸ A detailed analysis of these difficulties can be found in Hernández Bermejo (1990).

⁹ Among them, two works by Martín-Consuegra et al. (1995), and one by Casares et al. (2003).

¹⁰ Although these terms do not always correspond to clearly defined realities, it is possible to find characteristics attributed to each one. In Andalusí agricultural texts, *bustān* and *janna* refer to the two basic units of irrigated spaces; *bustān* is used to refer to "orchard," sometimes with ornamental or recreational connotations related to the delight of the senses, and *janna* referring to a property devoted to crop production. For further consultation, see García Sánchez (1995).

¹¹ The classical Arabic term *al-zīna* means something used for ornamentation, decoration or beauty, mainly referring to a decorative object. However, it also implies a figurative value, a physical, mental or social quality that beautifies or endows someone, in the widest sense of the word (Lane 2003, s.v. ZWN).

¹² *Zafareche* (Arabic *ṣahrīj*) is a pool; a tank in which water collects.

¹³ Jaol apple (Arabic *ruffāḥ sha' ḥā'*), literally means "vulgar apple." It is a kind of wild and small apple.

¹⁴ The Iberian lavender diversity gave rise to a rich Spanish vocabulary referring to this species: *alhucema, espoliego, lavanda, cantueso...*

¹⁵ *Rūmīyya*: Latin dialect spoken by Christians in the Iberian Peninsula.