NOMENCLATURE ARTICLE

Typification of the scientific names of the common almond *Prunus dulcis* and its wild relative *P. webbii* (Rosaceae, Prunoideae)

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Abstract The typifications of the scientific names of the common almond *Amygdalus dulcis* (≡ *Prunus dulcis*; Rosaceae, Prunoideae) and the Mediterranean almond tree *A. webbii* (≡ *P. webbii*), a wild relative of the common almond, are discussed. *Amygdalus dulcis* is neotypified on a specimen at VAL recently collected from a living tree of the variety of almond most similar to the original description. *Amygdalus webbii* is lectotypified on a specimen preserved at P collected by Pierre Martin Rémi Aucher-Éloy.

Keywords agriculture; *Amygdalus dulcis*; *Amygdalus webbii*; commercial crop; economic botany; lectotype; Mediterranean almond tree; Philip Barker Webb; Philip Miller

■ INTRODUCTION

Prunus L. (Rosaceae, Prunoideae) is a large and complex genus with almost 250 species, including many economically important fruit trees such as plums, cherries, peaches, nectarines, apricots and almonds (Faust & Timon, 1995; Faust & Surányi, 1997, 1999; Faust & al., 1998; Zohary & Hopf, 2000; Kalkman, 2004; Janick, 2011). The common almond, *P. dulcis* (Mill.) D.A.Webb (in Heywood, 1967: 24) belongs to *P.* subg. *Amygdalus* (L.) Focke and is one of the most important nut crops in the world, both in production yield and overall value (Menninger, 1977; Rosengarten, 1984; FAO, 2014). California (U.S.A.) produces most of the world's almonds, with an estimated production of 3.2 billion pounds in 2021 and a forecasted bearing acreage of 1,330,000 (USDA/NASS, 2021). Other major producers are Australia, Iran, Italy, Morocco, Spain, and Syria (FAO, 2014). Almond is also a species of great value in horticulture, generally planted for the beauty of its flowers and widely represented in the botanical gardens around the world (Kester & al., 1991; Browicz & Zohary, 1996; Hummer & Janick, 2009; Gradziel, 2010).

As well as a tasty and nutritious addition to the diet, almonds are also used medicinally, especially in the treatment of kidney stones, gallstones and constipation (Fairchild, 1902). Almond oil is used to treat dry skin conditions and as a carrier oil in aromatherapy (Ahmad, 2010; Michalak, 2018). The seeds also have demulcent, emollient and laxative properties (Ellison & al., 1978; Moertel & al., 1982; Milazzo & al., 2006) and the leaves and nuts are used in the treatment of diabetes (Jenkins & al., 2008). The whole plant is also a source of the anti-tumor compound taxifolin (Wang & al., 2020).

Due to its medicinal properties and frequent use in the food, pharmaceutical and cosmetic industries, the scientific name of the almond is cited in numerous laws regulating these sectors in most countries of the world. Several almond-derived ingredients are also listed in most pharmacopoeias of the world (e.g., United States Pharmacopoeia Convention, 2018; European Pharmacopoeia Commission, 2019), mainly: "almond oil" and "almond oil bitter" and their products such as "amygdalin" or "benzaldehyde" (Moertel & al., 1982; London-Shafir & al., 2003; Lee & al., 2013; Ferrara & al., 2015; Luo & al., 2018; United States Pharmacopoeia Convention, 2018; European Pharmacopoeia Commission, 2019). Some types of almond oil and their derivatives are also used in the cosmetic industry, and thus are heavily regulated, especially with regards to the mandatory inclusion of the ingredients names on product labels (e.g., International Nomenclature Cosmetic Ingredient [INCI] in the European Union, or the laws regulating cosmetics labeling in the U.S.A.; European Chemicals Agency – ECHA, 2021; European Commission, 2022; FDA, 2022). In this sense, it is unfortunate that pseudoscientific names such as "Prunus amygdalus amara kernel oil", "Prunus amygdalus amara seed oil", or "Prunus amygdalus sativa kernel extract" appear in official documents regulating the trade of almond-derived products (e.g., C/2019/2541, "Commission Decision [EU] 2019/701 of 5 April 2019, establishing a glossary of common ingredient names for use in the labelling of cosmetic products"). None of the designations cited above include the correct scientific name for the common almond which is *Prunus dulcis*.

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The natural range of the common almond seems to extend from the Arabian Peninsula to western Asia, but it is also cultivated and naturalized in the Mediterranean region and in temperate Asia (Webb, 1968; Wiersema & León, 1999; Zohary & Hopf, 2000). It has a long and well-documented history of cultivation (Candolle, 1890; Webb, 1968; Kester & al., 1991; Zohary & Hopf, 2000; Gradziel, 2010) and its supposed centre of origin is in the arid mountainous regions of Central Asia (Grasselly, 1976; Arús & al., 2009). Through the domestication process, humans made a significant impact on the development and distribution of almond and its wild relatives (Lansari & al., 1994; Martínez-Gómez & al., 2007; MirAli & Nabusi, 2007). The evolutionary relationships within the clade that includes the cultivated almond are however still largely unresolved, which may be explained by the low level of genetic divergence among the species (Bortiri & al., 2001; Yazbek & Oh, 2013).

The domestication of the common almond is considered to have started in Central Asia during the 3rd Millennium BC (Kovalyov & Kostina, 1935; Spiegel-Roy, 1986) and species such as *Prunus fenzliana* Fritsch., *P. bucharica* (Korsh.) Fedtsch., *P. kuramica* (Korsh.) Kitam. and *P. triloba* Lindl. were also most likely involved in various hybridization events (Grasselly & Crossa-Raynaud, 1980; Kester & al., 1991; Socias i Company & Felipe, 1992; Kester & Ross, 1996; Socias i Company, 1998). Further, as the cultivation of the common almond moved westward, new hybridizations might have occurred, especially with the wild Mediterranean species *P. webbii* (Spach) Vierh. (see below), resulting in the almond populations found today along the northern shores of the Mediterranean Sea from Greece and the Balkans eastward to Spain and Portugal (Felipe & Socias i Company, 1977; Godini, 2000; Socias i Company, 2004; Xu & al., 2004; Banović & al., 2009; Correa & al., 2021).

The cultivated almond is diploid ($2n = 16$) and self-incompatible, just as in the wild forms, except for some rare self-compatible cultivars (Socias i Company & al., 1976; Socias i Company & Felipe, 1988; Socias i Company, 1990; Ushijima & al., 2001; Bosković & al., 2007; Vieira & al., 2008). The gametophytic self-incompatibility system in almond is controlled by a single polymorphic locus containing at least two linked genes, one expressed in the pistil and the other in the pollen (Kao & Tsukamoto, 2004; Fernández i Martí & al., 2012).

The cultivated almond is derived from the wild forms which typically thrive in the Mediterranean environment (350–800 mm annual precipitation) and its domestication involved selection for types with sweet, non-poisonous seeds (i.e., without cyanogenic glycosides), larger drupes, and softer, thinner shells (Gabrielian & Zohary, 2004; Zohary & al., 2012; Fornés Comas & al., 2019). The mutation that favoured domestication is well known, affecting the transcription of the two genes involved in the amygdalin biosynthetic pathway (Sánchez-Pérez & al., 2019). The wild forms closely resemble the cultivated varieties in flower and leaf morphology, early blooming, and in their overall habit and climatic requirements, but differ mainly by smaller fruits, harder shells with fewer pits, and intensely bitter seed (Zohary & Hopf, 2000; Gabrielian & Zohary, 2004).

Taxonomic treatments for *Prunus* and its allied genera, where the common almond should be placed according to the most recent molecular studies, vary in different regional Floras (Eisenman, 2015). Some botanists, particularly from Asia and Europe, maintain the generic status of *Amygdalus* L. (e.g., Zhukovsky, 1971; Zohary, 1972; Browicz, 1989; Browicz & Zohary, 1996; Czerepanov, 2007; Vafadar & al., 2014). Others (e.g., Brummitt, 1992; Kalkman, 2004), treat *Amygdalus* as a synonym of *Prunus*. Major taxonomic databases (e.g., USDA Plants Database, The Integrated Taxonomic Information System [ITIS], Euro+Med Plantbase, and Catalogue of Life) also adopt the use of a more broadly circumscribed *Prunus* (e.g., Kurtto, 2009; Bánki & al., 2021; ITIS, 2022; POWO, 2023; Tropicos, 2023, USDA/NRCS, 2023).

The common almond was described by Linnaeus (1753: 473) as *Amygdalus communis* L. This would be the correct scientific name for it if the generic status of *Amygdalus* was to be maintained, but the results of the most recent phylogenetic studies suggest inclusion of *Amygdalus* and its related genera within the broadly circumscribed *Prunus* s.l. (Bortiri & al., 2001; Yazbek, 2010; Eisenman, 2015) which necessitates a name change. The combination *P. communis* (L.) Arcang. was published by Giovanni Arcangeli in 1882 and has been widely used ever since, but David Webb discovered in 1967 (see Heywood, 1967: 24) that this is actually an illegitimate later homonym of *P. communis* Huds. (Hudson, 1778: 212), a heterotypic synonym of the common plum (*P. domestica* L.; Linnaeus, 1753: 475). Therefore *P. communis* (L.) Arcang. cannot serve as the correct name for the common almond under Art. 6.6 of the *ICN* (Turland & al., 2018). Prompted by Wim Punt's suggestion that *A. dulcis* Mill. (Miller, 1768: *Amygdalus* No. 2) is the next oldest binomial available for this taxon (see Stafleu, 1964: 9), Webb published a new combination *P. dulcis* (Mill.) D.A.Webb., which accordingly is the correct name for the common almond.

In his account of the genus *Amygdalus*, Philip Miller restricted the use of the Linnaean name *A. communis* to the cultivars grown purely for their decorative flowers and described the variety with large, soft-shelled fruits and sweet kernels commonly known as "Jordan almond" as a separate species which he named *A. dulcis* Mill. (Miller, 1768: *Amygdalus* No. 2). In the same publication Miller also described the white-flowered cultivar of the common almond as *A. sativa* Mill. (Miller, 1768: *Amygdalus* No. 3) and another species with distinctively white-tomentose leaves as *A. orientalis* Mill. (Miller, 1768: *Amygdalus* No. 4). Finally, at the end of his account, Miller also included his own description of the dwarf species already named by Linnaeus as *A. nana* L. (Miller, 1768: *Amygdalus* No. 5). Given this context, there is no doubt that *A. dulcis* and *A. sativa* belong to what Linnaeus treated as a broadly circumscribed *A. communis* and both names are generally considered to be its taxonomic synonyms (Wiersema & León, 1999; Kurtto, 2009; POWO, 2023;

USDA/NRCS, 2023; WFO, 2023). When these three species are transferred to *Prunus*, as suggested by the most recent molecular studies, the name *A. dulcis* has priority because the other combinations are blocked by *P. communis* Huds. (as explained above) and by *P. sativa* Rouy & E.G.Camus (Rouy & Camus, 1900: 4) (see Punt in Stafleu, 1964: 9).

Another binomial, *Prunus amygdalus* Batsch (1801: 30), published as a replacement name for *Amygdalus communis* is accepted by some sources (e.g., Ruiz de la Torre, 2006; IPNI, 2021) as the correct name for the common almond. Batsch's name however, was published much later than *A. dulcis* and when these two names compete at the rank of species within the genus *Prunus*, the latter name (i.e., *A. dulcis*) has priority because it is the earliest legitimately published name that can provide the final epithet at this particular rank (*ICN* Art. 11.4; Turland & al., 2018). *Amygdalus communis* was lectotypified by Jafri (in Jafri & El-Gadi, 1977: 12) with a specimen in the Clifford Herbarium at BM. The type for *A. dulcis* however, has not been formally selected.

The Mediterranean almond tree *Prunus webbii* is one of the wild relatives of the common almond (Browicz, 1974; Felipe & Socias i Company, 1977; Godini, 2000; Socias i Company, 2002, 2004; Banović & al., 2009; Szikriszt & al., 2011; Correa & al., 2021). It was described from the Anatolian Peninsula (Asia Minor) as *Amygdalus webbii* by Spach (1843) but is widespread in the Mediterranean areas of central and eastern Europe, southwest Asia (Aegean Sea and its islands, except the North Aegean Islands), Crete, mainland Greece (Peloponnese, Attica and Argolis), Macedonia, south Bulgaria, south and central Albania (Vierhapper, 1915; Browicz, 1974; Grasselly, 1976; Vangjeli, 2017), Montenegro (Kotor), North Macedonia (Kruševo), Bosnia and Herzegovina (Gabela, Stolac and Fatnica), Croatia (Vlasic, 1977), Italy (incl. Sicily), Spain, (Webb, 1968; Felipe & Socias i Company, 1977; Godini & al., 2009; Silletti, 2009; Yazbek, 2010; POWO, 2023), and North Africa (Guelma, Tlemcen and Ain Defla [Djebel Zaccar Rherbi] in Algeria; Rif area and Fez-Taza in Morocco) (Battandier, 1889; Jahandiez & Maire, 1932; African Plant Database, 2022). Ladizinsky (1999) concluded that *P. webbii* is a derived form of the cultivated almond and not a genuine wild type, but field observations at several sites by Felipe (1984) suggest that it should be treated as a separate species. A wide cross-compatibility among different species of almond can also cause problems with accurate identification, leading to taxonomic confusion (Felipe & Socias i Company, 1977; Godini, 2000; Socias i Company, 2002, 2004; Banović & al., 2007, 2009). Here we typify the names *P. dulcis* and *P. webbii* with the explicit purpose of stabilising the use of these two names and fixing their correct application.

■ MATERIALS AND METHODS

This work is based on the examination of the relevant literature and on the study of the specimens preserved at BM, FI, G, P, and VAL. In our search for a suitable candidate for neotype for *Amygdalus dulcis* we first tried to locate an extant tree at the Chelsea Physic Garden from which a gathering could be made, but we were informed that currently there is no almond tree in cultivation there as the last specimen died of a honey fungus infection a few years ago (Chelsea Physic Garden, pers. comm.). Following this disappointing discovery, we carried out field work in southern Spain and surrounding areas in order to locate the trees that fully agree with the morphological characters described by Philip Miller in the protologue of *A. dulcis*. The largest almond marketing companies in Andalusia were also contacted for information about the current names of the soft-shelled varieties grown by their suppliers and their geographical distribution. We also asked the individual producers known to grow a wide range of different varieties of almonds if the trees similar to those described by Miller were present in their orchards. The farms with possible matches for *A. dulcis* were visited and the plant material was collected for a detailed study in our lab.

The material was studied using a binocular microscope, focusing on the morphological characters described by Miller (1768) in the protologue of *Amygdalus dulcis*. The scientific literature on the taxonomy of the wild and domesticated almonds was consulted to distinguish between the most common varieties (Gülcan, 1985) and the Andalusian and other local Spanish cultivars (López Palazón, 1962; Ramos Carmona, 1983; Navarro Muñoz, 2002; Salazar & Melgarejo, 2002; Ricarte Sabater, 2006; Felipe & al., 2022; Climent Sirvent, 2023).

■ TYPIFICATION OF THE NAMES

Common almond tree *Prunus dulcis*. — The protologue of *Amygdalus dulcis* Mill. (Miller, 1768: *Amygdalus* No. 2) includes a Latin diagnosis "2. AMYGDALUS (*Dulcis*) foliis petiolatis marginibus crenatis, corollis calyce vix longioribus" and its English translation "*Almond-tree with crenated leaves, having foot-stalks, and the petals of the flowers no longer than the empalement*", followed by the synonym "Amygdalus dulcis putamine molliori. C. B. P. 441" (this reference being to Bauhin, 1623: 441) and the common name "Jordan Almond". A further description is also given in the main article on the genus *Amygdalus*: "The second sort is commonly known by the title of Jordan Almonds; the nuts of this kind are frequently brought to England; these have a tender shell, and a large sweet kernel. The leaves of this tree are broader, shorter, and grow much closer than those of the common sort [i.e., *A. communis*], and their edges are crenated. The flowers are very small, and of a pale colour, inclining to white. I have several times raised these trees from the Almonds which came from abroad, and always found the plants to maintain their difference from the common Almond."

Miller's description leaves no doubt that he intended the name *Amygdalus dulcis* to be used for the type of the common almond that is grown for its edible, soft-shelled fruits with sweet (i.e., non-poisonous) seeds. Sadly, there are no extant herbarium specimens that can be explicitly linked to this

description. There are only two specimens of the common almond at BM that date to Miller's time, but they both correspond to what he treated as *A. communis* in the 8th edition of *The gardeners dictionary*. The first specimen (barcode BM001172984) was grown at the Chelsea Physic Garden in 1736, when Miller was in charge as its director (Le Rougetel, 1990), but it was collected and sent to the Royal Society by Isaac Rand, not by Miller, to fulfil the requirements of Sir Hans Sloane's deed of conveyance to the Society of Apothecaries (Stearn, 1972), so it cannot be treated as original material for Miller's name. This specimen was never in Miller's own herbarium, which Sir Joseph Banks purchased in 1774, and came to BM with the rest of the Royal Society's botanical collections in 1781 (Stungo, 1993). It is also annotated in a hand that does not belong to Miller as "*Amygdalus sativa*. C.B. 441" (Fig. 1), which is the polynomial that was cited in the *Dictionary* in the synonymy of *A. communis*, not of *A. dulcis*. The second sheet (barcode BM001172985) consists of two branches with flowers, one of which (the left) is poorly preserved, and a central branch with leaves and a fruit (Fig. 2). It was annotated by Daniel Solander as "Hort." on the verso, which might indicate a specimen cultivated by Miller at the Chelsea Physic Garden (Britten, 1913). The specimen was also identified by Solander as "*Amygdalus communis* L.M." in pencil at the bottom of the sheet, which can be interpreted as: "*A. communis* L. as described in Miller's Dictionary". However, it lacks any annotations by Miller and cannot be directly linked to the protologue, therefore we do not consider it to be original material (Art. 9.4 of the *ICN*). *Amygdalus dulcis* was definitely cultivated at the Chelsea Physic Garden at some point because Isaac Rand listed it under Bauhin's polynomial in his catalogue of the plants grown at Chelsea published in 1739 (Rand, 1739). A supporting voucher was likely never made, or if it was, it is now apparently lost.

Bauhin's polynomial, cited by Miller in synonymy, does not have a corresponding illustration which could potentially serve as a lectotype for *Amygdalus dulcis*. Interestingly, Bauhin (1623: 441–442) did not coin the phrase name "Amygdalus dulcis putamine molliori" cited by Miller. This polynomial

Fig. 1. Specimen of almond (*Amygdalus communis*) grown at Chelsea during Miller's time but not collected by him, preserved at BM, with barcode BM001172984. Image courtesy of the Trustees of the Natural History Museum, London, reproduced with permission.

Fig. 2. Specimen of almond (*Amygdalus communis*) grown at Chelsea during Miller's time and probably collected for his own herbarium, preserved at BM, with barcode BM001172985. Image courtesy of the Trustees of the Natural History Museum, London, reproduced with permission.

was actually first published by Hermann (1687: 34), and also by Sherard (1689: 285), Cupani (1696: 12), Magnol (1697: 13), and Tournefort (1719: 627) as reference to Bauhin's mention of the sweet (i.e., "dulcis") and soft-shelled (i.e., "putamine molliori") type of the common almond included in the much longer description of *Amygdalus* No. 1 or "*Amygdalus sativa*" in Bauhin (1623: 441). The genus *Amygdalus* has a corresponding illustration that was published by Tournefort (1719: t. 402). This plate matches the current concept of *P. dulcis* (e.g., shows flowers with broadly campanulate hypanthium, ovoid petals, compressed ovoid-oblong fruit and lanceolate seed), but it is not in any way linked to Bauhin's polynomial listed by Tournefort and therefore it is not part of the original material used by Miller to describe *A. dulcis* and cannot serve as its lectotype.

Miller also had two species of almond illustrated on plate 28 of his *Figures of the most beautiful, useful, and uncommon plants* (Miller, 1755–1760) (Fig. 3), published in 1755 as part of a supplement to the *Dictionary* (McClintock & Fryxel, 1979.). However, this plate shows what Miller considered to be *Amygdalus communis* (Miller, 1755–1760: pl. 28, fig. 1a–c and the associated text on page 19) and *A. nana* L. (Miller, 1755–1760: pl. 28, fig. 2 and the associated text on page 19), therefore it cannot be treated as an element of the original material for *A. dulcis*. The twig depicted as *A. communis* in pl. 28 fig. 1 has large pink flowers and large drupes and was identified by Miller as "*Amygdalus sativa fructu majore* C.B.P. 441" (Fig. 3 herein). This polynomial was not cited in the protologue of *A. dulcis* (Miller, 1768), but instead in all earlier editions of the *Dictionary* this was the name under which Miller listed the common almond (i.e., *A. communis*), not the "Jordan Almond" (i.e., *A. dulcis*) (e.g., the 2nd edition, Miller, 1733: *Amygdalus* No. 1; the 6th edition, Miller, 1752: *Amygdalus* No. 1). In the text associated with the illustration, Miller discussed the differences between *A. communis* and *A. dulcis*, and evidently it was this discussion that led the illustrated plant to be incorrectly identified as the "Sweet or Jordan Almond" by Thomas Martyn in the 9th edition of the *Dictionary* (Miller & Martyn, 1795–1807: under the entry for *Amygdalus communis* L. [No. 2], var. β [*A. sativa*]). This error was repeated in the third edition of the *Figures* (Anonymous, 1809, vol. 1: 6), which was allegedly also edited by Martyn. Consequently, McClintock & Fryxel (1979: 134 & table 2) treated the plant depicted on pl. 28 fig. 1 as *Prunus dulcis* (Mill.) D.A.Webb in their historical overview of the third edition of the *Figures*.

It is quite clear that Miller's pl. 28 fig. 1 depicts the form of the common almond that is grown for its large, decorative, pink flowers (Miller, 1733, 1752, 1756–1759) which Miller listed under the name *Amygdalus communis* in the 8th edition of the *Dictionary* (Miller, 1768). It is possible that the fruit and the exposed stone included at the bottom of the plate were drawn from a different plant and added separately as they are not shown attached to the stem, but there is no indication in the legend that the seed is sweet or that the outer shell is softer than in the common sort, thus they cannot be explicitly associated with Miller's concept of *A. dulcis*. There is also no evidence that the two specimens at BM discussed above are supporting vouchers or typotypes of this illustration.

In conclusion, as an exhaustive search for original material of *Amygdalus dulcis* failed to locate any extant herbarium specimens or suitable illustrations, a neotype is proposed here in conformity with Art. 9.8 of the *Shenzhen Code* (Turland & al., 2018). Our process for selecting the neotype is outlined in detail below.

Miller cited the name "Jordan almond" but did not indicate the source of the name and whether it was connected to material that he had examined. Importantly, when Miller described the "Jordan almond" he referred to a specific variety of almond tree, not to the sugar-coated almonds, also called "Jordan almonds" or "dragée" in several European countries (Chalak, 2014). The name 'Jordan almond' was commonly used for an almond variety during Miller's times as evidenced by contemporaneous cook books (e.g., May, 1665: 269; Nott, 1724),

Fig. 3. Illustration of *Amygdalus communis* L. from *Figures of the most beautiful, useful, and uncommon plants* (Miller, 1755–1760), pl. XXVIII, fig. 1. "AMYGDALUS *sativa fructu majori* C.B.P. 441".

pharmaceutical manuals (e.g., Anonymous, 1847; Squire, 1864: 21) and later agricultural guidebooks (Fairchild, 1902; Wood, 1924). Several authors (Wood, 1924; Grasselly & Crossa-Raynaud, 1980) treated the name 'Jordan almond' as being synonymous with other variety names (e.g., 'Malagueña', 'Malagueña Jordan', 'Jordana', 'Fina Malagueña'). A complete morphological description of this variety was published by Wood (1924) with an illustration of the fruit and the seed (see Wood, 1924: pl. VIII.B). The 'Jordan almond' (sensu Wood, 1924) is a relatively early blooming variety (it would freeze in places with temperatures below zero in the month of February or early March) with a regular and high bloom density (Wood, 1924). It is also a self-incompatible and very productive tree, but its main feature is a high percentage of fruits with double seeds (>80%; Martínez-García & al., 2014). Recently, it has also been a subject of pomological (Martínez-García & al., 2014) and genetic studies (Fernández i Martí & al., 2009). Therefore, 'Jordan almond' as a synonym for the locally used varietal name 'Malagueña mollar' is an old variety native to the south of Spain where it is cultivated in extremely dry situations.

Apparently, at least in England, the name "Jordan" was widely applied by commercial buyers to "the best variety" of almond while the name was not actually used by those who grew the trees (Fairchild, 1902: 10). Fairchild (1902: 11 & fig. 2) also provided a detailed description of the so called 'Jordan' variety as well as an illustration (Fig. 4). The name and fame of this almond variety can be traced back to the 18th century, to a Spanish book describing tariffs on exports of various products (Virio, 1792: 236). By the early 21st century it was so highly prized that the growers in Spain were cited by a U.S. official as being unwilling to share information about it (Benjamin H. Ridgeli, former U.S. consul in Malaga, letter dated 21 August 1901). According to Wood, this type of almond was imported into the United States from Spain and was also cultivated at the United States Plant Introduction Garden at Chico, California, in 1912 (Wood, 1924). Since then, the trees of the 'Malagueña mollar' or 'Jordan' variety have been distributed to practically every almond-growing district in the country, but no large plantings were ever made (Wood, 1924) and the variety is no longer widely cultivated around the world in the regions where almonds are grown.

Combining all the information collected by us on the 'Jordan almond' with Miller's description, our next step was to look for the living specimens of this variety grown in Spain today. Unfortunately, no trees matching the description of *Amygdalus dulcis* are currently grown in any of the three most important Spanish collections of almond trees: Fruit Tree Germplasm Bank of the CITA (Centre for Research and Agrifood Technology of Aragón) in Zaragoza, established by A.J. Felipe in the 1960s (Espiau & al., 2002), IRTA (Institute of Research and Agrifood Technology) in Tarragona, and the CEBAS-CSIC (Centro de Edafología y Biología Aplicada del Segura – Consejo Superior de Investigaciones Científicas) in Murcia. Some 'Malagueña' trees are grown at

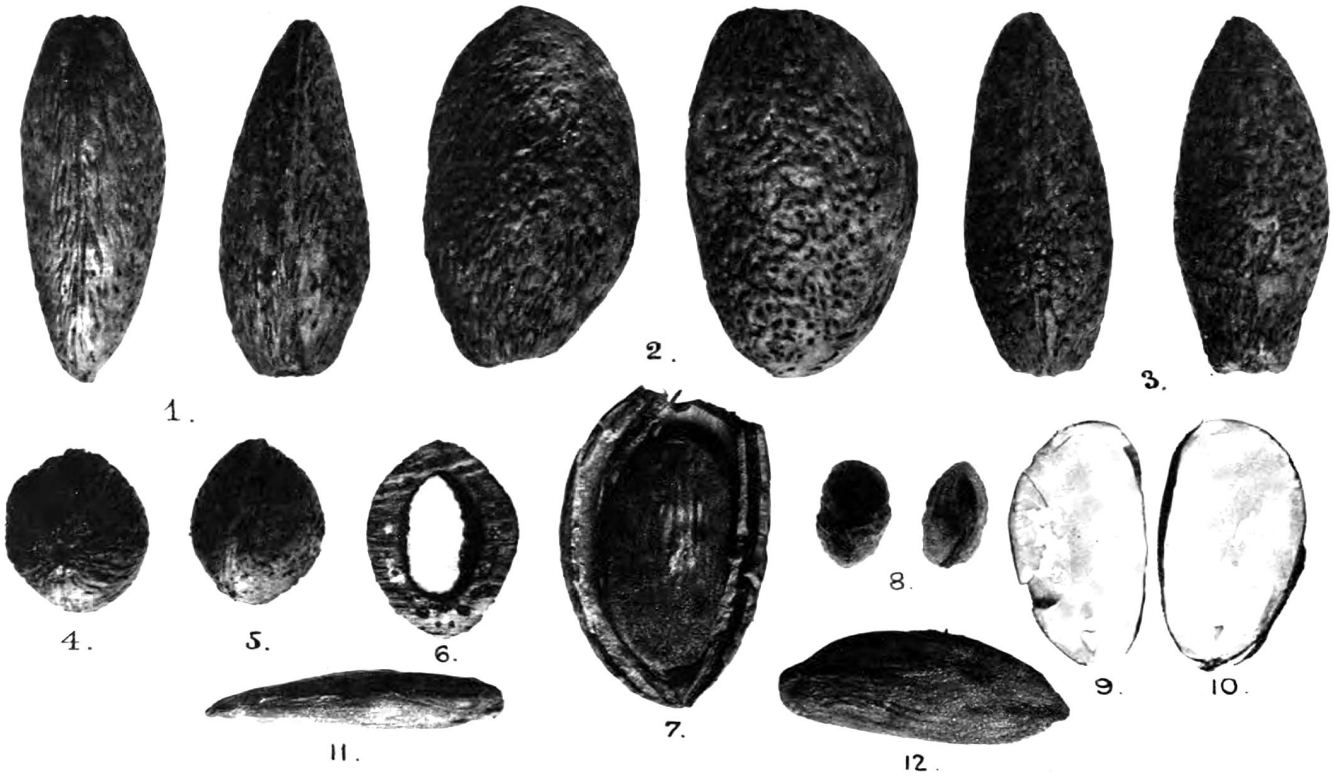

Fig. 4. 'Jordan almond' from the frontispiece of Fairchild's (1902) *Spanish almonds and their introduction into America*.

the CITA collection in Zaragoza. They were provided by C. Grasselly from the French National Institute of Agronomic Research INRA (Institut National de la Recherche Agronomique) in 1977 and grown as a reference collection for the Group de Recherches et d'Études Méditerranéen pour l'Amandier (GREMPA), later also used by the Spanish Plant Genetic Resources Network and by the Spanish and the European Plant Variety Offices (Socias i Company & Felipe, 1992) for their own research projects. However, these trees have drupes with hard shells (Martínez-García & al., 2014; M. Espiau, I. Batlle, J. Egea, F. Dicenta, pers. comm.) which is at odds with Miller's description of *A. dulcis*. Thus, it seems that perhaps varieties 'Jordan' and 'Malagueña' might not be synonymous but more investigation is needed to confirm that.

After a long and exhaustive search for the 'Jordan almond' in the rest of Spain, we finally located a relevant but scarce population in an ancient orchard in the Granada Province (Cádiar, Cortijo los Mateos). The local growers currently call this variety 'Malagueño mollar' and refer to it as one of the oldest varieties of the Axarquía, Contraviesa and Alpujarra regions. The age of the oldest tree is unknown, but according to the farm owner it has been alive for at least three human generations. The population is in decline because local varieties have been slowly replaced by modern late-flowering (fewer fruits are lost due to late frosts) and more productive (generally self-fertile) alternatives since the middle of the 20th century. However, 'Malagueño mollar' remains cultivated on some farms because, owing to its sweetness and ease of breaking the skin (mollar), it is preferred for the family use. The highly restricted distribution of this variety means that it is little known outside of its current range and is not cited in the general literature on the local varieties of almond in south-eastern Iberia (López Palazón, 1962; Ramos Carmona, 1983; Navarro Muñoz, 2002; Salazar & Melgarejo, 2002; Ricarte Sabater, 2006; Felipe & al., 2022; Climent Sirvent, 2023). Despite this, 'Malagueño mollar' is well known and easily distinguished from other varieties by its growers.

Several specimens of this rare almond variety were collected with an aim to select a neotype for Miller's name. They match the traditional concept (e.g., Miller, 1768; Candolle, 1890) and the current use of the name *Almond dulcis* (e.g., Webb, 1968; Kester & al., 1991; López González, 2001; Ruiz de la Torre, 2006; Yazbek, 2010) and clearly show some key diagnostic features of this species such as the crenate leaves, large sweet seeds and tender shell (mesocarp), which were all mentioned by Miller in the protologue ("foliis petiolatis marginibus crenatis" and "The leaves of this tree are broader, shorter, and grow much closer than those of the common sort, and their edges are crenated"). The current vernacular name of this variety in South Spain is 'Malagueña mollar' (the word "mollar", defined as "soft and easy to break" [Real Academia Española, 2023], is generally used for the tender-shelled fruit varieties).

Amygdalus dulcis Mill., Gard. Dict., ed. 8: *Amygdalus* No. 2. 1768 ≡ ***Prunus dulcis*** (Mill.) D.A.Webb in Feddes Repert. 74: 24. 1967 – **Neotype (designated here):** Spain, Granada, Cádiar, Cortijo los Mateos, en la ladera sur de la Sierra de la Contraviesa, 36°53′24.7″N 03°13′15.4″W, alt. 1150 m, 7 Jun 2022, *G. Benítez & J. Morón s.n.* (VAL barcode VAL 250061!; isoneotypes: BM!, G barcode G00398272!, GDA barcode GDA-Fanero 70799!, MA barcode MA-01-00959510!).

= *Amygdalus communis* L., Sp. Pl.: 473. 1753 ≡ *Prunus amygdalus* Batsch, Beytr. Entw. Gewächsreich 1: 30. 1801 ≡ *Prunus communis* (L.) Arcang., Comp. Fl. Ital.: 209. 1882, nom. illeg., non Huds., Fl. Angl., ed. 2, 1: 212. 1778 – Lectotype (designated by Jafri in Jafri & El-Gadi, Fl. Libya 31: 12. 1977): [Cultivated in the Netherlands] Herb. Clifford: 186, *Amygdalus* 2 (BM barcode BM000628608!).

The neotype of *Amygdalus dulcis* Mill. is shown in Fig. 5.

Mediterranean almond tree *Prunus webbii*. — The protologue of *Amygdalus webbii* (Spach, 1843: 117–118) includes a diagnosis in Latin: "Foliis oblongis v. lanceolato-oblongis, crenulatis, v. serrulatis, obtusis, v. acuminulatis, brevè petiolatis, ramulisque glabris. Drupis ovalibus, v. ovatis, v. ovato-oblongis, acuminulatis, incano-velutinis;

Fig. 5. Neotype of *Prunus dulcis* (Mill.) D.A.Webb; VAL barcode VAL 250061. Image courtesy of the herbarium VAL, reproduced with permission.

putamine foraminato, angustè carinulato, laevigato", followed by a complete description in Latin and the provenance "Crescit in Asiâ Minori: cl. *Webb!* (ager trojanus, «ad radices collium *Bonarbaschi* dictos, prope *Kirk Ghios*»); *Coquebert de Montbret!* (in Herb. cl. *Webb*); *Aucher Eloy!* (in Herb. Mus. Par., cum *Amygdalo lycioide*, Nob., sub n. 1426)".

We found two specimens in the Philip Barker Webb Herbarium at FI, with barcodes FI018955 and FI018956, that are original material. The specimen FI018955 is a branch with leaves and accompanied by two labels: (1) "1426 | Amygd. Communis | Aucher Eloy" and (2) "Herb. Webbianum. | Amygdalus Webbii Spach. | Ex Herb. Gustavi Coquebert de Montbret". The specimen FI018956 consists of two branches, with leaves on the branches, and four fruits, and is accompanied by two labels: (1) "Amygdalus communis Trojana Nob | frutex ad colles Bonarbaschi dictos | qua Perpamum [illegible]" and (2) "Herb. Webbianum. | Amygdalus Webbii Spach | Amygdalus Trojana Nob. | Ad radices collinum prope Kirk Ghios in | agro Trojano circa Kutchuk Bonar-baschi". There are also specimens at P (barcode P00511901) and G (barcode G00398273!) that are original material and belong to the gathering collected in 1837 by Pierre Martin Rémi Aucher-Éloy, and numbered as 1426. This material was cited in the protologue as "*Aucher Eloy!* (in Herb. Mus. Par., cum *Amygdalo lycioide*, Nob., sub n. 1426)".

All specimens listed above match the description of *Prunus webbii* and are suitable for lectotypification. However, the herbarium material at FI (FI018955, FI018956) does not include the date of collection. We prefer to designate the specimen P00511901 as the lectotype of this name because it bears an original printed label of the Aucher-Éloy Herbarium, with the date 1837, and the number "1426" of the gathering indicated in the protologue (Fig. 6). This specimen shows diagnostic features of the taxon as the branches are spiny and strongly divaricate and the leaves are 3–5 × 0.6–0.9 cm (Webb, 1968; Browicz, 1974; Felipe & Socias i Company, 1977; Godini & al., 2009; Correa & al., 2021). Therefore, we designate this specimen as the lectotype of *Prunus webbii*.

Fig. 6. Lectotype of *Prunus webbii* (Spach) Vierh.; P barcode P00511901. Image courtesy of the herbarium P, reproduced with permission.

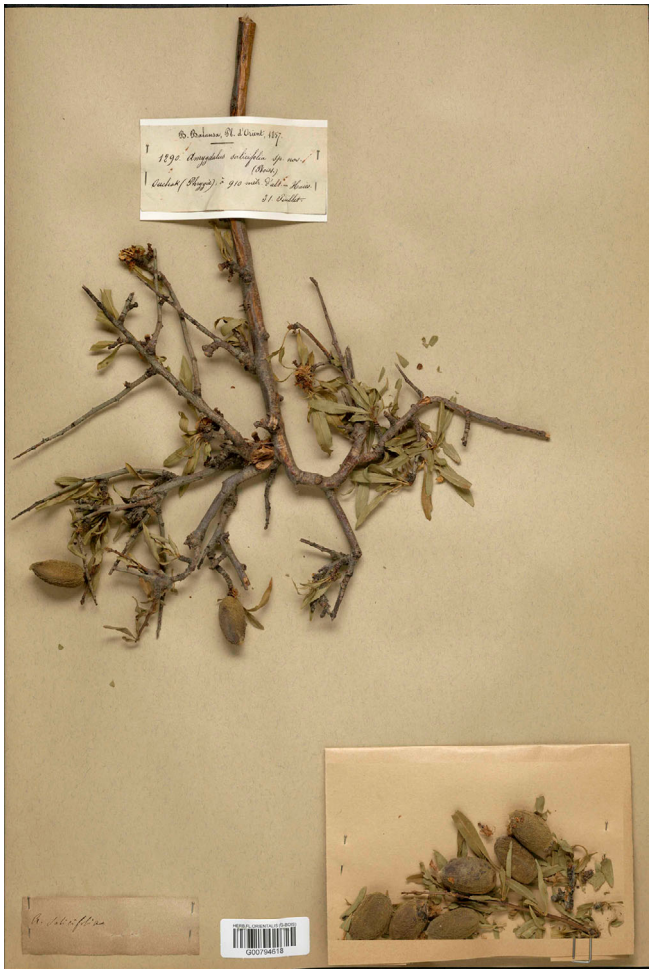

Fig. 7. Lectotype of *Amygdalus salicifolia* Boiss. & Balansa; G barcode G00794618. Image courtesy of the herbarium G, reproduced with permission.

Finally, the protologue of *Amygdalus salicifolia*, treated here as a taxonomic synonym of *A. webbii* (Euro+Med, 2006–; African Plant Database, 2022; POWO, 2023; WFO, 2023), includes the provenance "Hab. in sepibus propè *Ouchak*" and some additional collecting information "cl. Balansa legit fructiferam fine Julii". There are several duplicates of the corresponding gathering by Benedict Balansa preserved at BM, G-BOIS, GOET, JE, K, and P, all bearing an original printed label annotated as: "B. Balansa, Pl. d'Orient, 1857. | 1290. Amygdalus salicifolia sp. nov. | (Boiss.) | Ouchak (Phrygie), à 910 mètr. d'alt. – Haies | 31. Juillet." They all match the description of *A. salicifolia* and are suitable for typification. However, the specimen from the Boissier Herbarium at G-BOIS with barcode G00794618 is the most complete one, with a well-preserved branch, with both leaves and fruits. We therefore designate it here as the lectotype of *Amygdalus salicifolia* (Fig. 7).

Amygdalus webbii Spach in Ann. Sci. Nat., Bot., ser. 2, 19: 117. 1843 ≡ ***Prunus webbii*** (Spach) Vierh. in Oesterr. Bot. Z. 65: 21. 1915 – **Lectotype (designated here):** [Turkey], "Asia Minor", "Agro Trojano, Troy", 1837, *P.M.R. Aucher-Éloy 1426* (P barcode P00511901!; isolectotype: G barcode G00398273!).

= *Amygdalus salicifolia* Boiss. & Balansa in Boissier, Diagn. Pl. Orient., ser. 2(6): 71. 1859 ≡ *A. webbii* ["β"] var. *salicifolia* (Boiss & Balansa) Boiss., Fl. Orient. 2: 642. 1872 – **Lectotype (designated here):** Turkey, Phrygie, Ouchak [Uşak], 31 Jul 1857, *B. Balansa 1290* (G-BOIS barcode G00794618!; isolectotypes: BM barcode BM000622010!, G-BOIS barcode G00794617!, G barcodes G00398310 [2 sheets]!, G00080129!, GOET barcode GOET010060!, JE barcode JE00000663!, K barcode K000395315!, P barcodes P00511904!, P00511905!).

Lectotypes are shown in Figs. 6 and 7, respectively.

■ AUTHOR CONTRIBUTIONS

PPFG, Conception, design, nomenclatural analysis and consulting specialists, and writing; JW, Conception, literature and text review; GB; Conception, selection of plant materials, literature and text review. — PPFG, http://orcid.org/0000-0001-7595-9302; JW, https://orcid.org/0000-0002-2329-9186; GB, https://orcid.org/0000-0003-2928-7423

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