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An investigation on the determination of pomological and morphological traits of wild almond grown at _anliurfa province

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SUMMARY – There are two types of wild almonds grown naturally or edge plant of pistachio orchards in the southeastern Anatolia Region; they are *Amygdalus orientalis* (*A. argentea*) and *Amygdalus turcomanica*. The leaves of *Amygdalus orientalis* are hairy, gray in colour and large. It blooms earlier than *Amygdalus turcomanica*. The shoots are hairy. The plant is semi-dwarf. Fruit taste of this genus is bitter. The leaves of *Amygdalus turcomanica* are hairless, green in colour and smaller than *Amygdalus orientalis*. It has late blooming characteristics. The shoots are hairless and thorny. The plants are very dwarf. The morphological and pomological traits of these two genus are discussed in this paper.

Key words: Fruit traits, *Amygdalus orientalis*, *Amygdalus turcomanica*.

RESUME – "Recherches pour la détermination des caractères pomologiques et morphologiques d'amandiers sauvages cultivés dans la province de _anliurfa". Il existe deux types d'amandiers qui poussent naturellement ou se trouvent en lisière des vergers de pistachiers dans le sud-est de la région d'Anatolie. Il s'agit d'*Amygdalus orientalis* (*A. argentea*) et *Amygdalus turcomanica*. Les feuilles d'*Amygdalus orientalis* sont villesues, grandes et de couleur grise. Il fleurit plus tôt qu'*Amygdalus turcomanica*. Les pousses sont villesues. La plante est semi-naine. Le goût du fruit de ce genre est amer. Les feuilles d'*Amygdalus turcomanica* sont glabres, de couleur verte et plus petites que celles d'*Amygdalus orientalis*. Il présente des caractéristiques de floraison tardive. Les pousses sont glabres et épineuses. Les plantes sont très naines. Les caractères morphologiques et pomologiques de ces deux genres sont discutés dans cet article.

Mots-clés : Caractères du fruit, *Amygdalus orientalis*, *Amygdalus turcomanica*.

Introduction

The origin of almond is central and west Asia. It is scattered and settled down toward east to China and India, and toward west to north Iran, Syria and Mediterranean countries. However, dwarf bitter almond (*Amygdalus nana*) has settled down with wide variations in Anatolia. Therefore, Turkey can also be accepted as origin of almond. Dwarf bitter almond can be seen as a characteristic fruit species among the bushes which have covered arid and bared hills of Anatolia (Özbek, 1978).

Dwarf bitter almonds (*Amygdalus nana*) are thorny bushes. The fruits are very small, hard and have thick shell. They are quite resistant to drought. Therefore, the trees which are well compatible with almond cultivars as dwarf rootstock can be selected among this species and they can be used in almond production (Özbek, 1978).

The wild almond, *Amygdalus (Prunus) webbii*, can be used as rootstock for almond, nectarine and peach (Alberghina, 1978), for cultivated almond (Dimitrovski and Ristevski, 1973a,b).

According to Dimitrovski and Ristevski (1973b), wild almond [*Amygdalus (Prunus) webbii*] is dwarf rootstock for cultivated almond. They report that, seedlings of *Amygdalus (Prunus) webbii* made 30-50% less growth than those of *Prunus communis* and almond cvs grafted on *P. webbii* showed a similar reduction in vigour.

Almond is growing at the marginal areas, poor, rocky and stony, and calcareous soils in Turkey. Because of hard resistance of drought conditions, almond trees have been used in afforestation of rainfed areas (Ka_ka et al., 1999).

There are different sections related wild almond species. Kester *et al.* (1990) reported that, related wild species have been classified into five taxonomic sections (Grasselly, 1976; Denisov, 1988).

(i) *Eumygdalus* Spach Section: this section contains the ancestral species of the modern cultivated almond. These species are:

- *Prunus bucharica* Korschinsky.
- *P. communis* (L.) Archang.
- *P. fenzliana* Fritsch.
- *P. curamica* Korschinsky.
- *P. orientalis* (Mill), [= *P. argentea* (Lam) Redh. = *P. kotschy* (Boissier and Hohen) Nab. = *P. korchinskii* Hand-Mazz.] appear to be the same or closely related species that occur in the mountains of Iraq, Syria and western Iran extending into Turkey.
- *P. tangutica* Batal, *P. dehiscentes* Koehne.
- *P. webbii* (Spach) Vieh.
- *P. zabulica* Serafimov.

(ii) *Spartioides* Spach Section: this section represents a complex of a number of species of similar morphology which are adapted to the extreme xerophytic conditions found on steppe and low desert areas. Species of this section:

- *P. sportioides* Spach.
- *P. arabica* Olivier.
- *P. glauca*.

(iii) *Lycioides* Spach Section: this section represents another large group of variable plants extending across a wide area from northeastern Iraq, through Iran, Afghanistan, southern Armenia and into southern Tadjikistan. Typical species in this section:

- *P. spinosissima* Franchet, *P. turcomanica* Lincz.
- *P. brahuica* Bossier.
- *P. eburnea* Spach.
- *P. erioclada* Borhm.
- *P. horrida* Spach.
- *P. lycioides* Spach.

(iv) *Chameamygdalus* Spach Section: the type species is *P. nana* Stock (*P. tenella* Batsch).

(v) *Leptopus* Spach Section: *Prunus pedunculata* Pall and *P. mongolica* Maxim ex. are type species of this section.

In this study, we aimed to determine pomological and morphological characteristics of three different types of *Amygdalus orientalis* and one type of *Amygdalus turcomanica* wild almond species which are grown around _anliurfa province. They are compared with *Amygdalus webbii* fruits.

There are a lot of trees and types of *A. orientalis* around the _anliurfa province, and they are using as edge and border plants around the pistachio orchards and vineyards. In this region, the number of *A. turcomanica* is less. We can only find a few bushes at different places.

(i) *Amygdalus orientalis* (Figs 1 and 2): it has early flowering stage. It is flowering before the *Prunus communis* types and the other almond cultivars. The trees and leaves are larger than *A. turcomanica*'s. The leaves are hairy and gray coloured and similar to elaeagnus (*Elaeagnus orientalis*). Fruit yield is very good and the nuts are light brown. Fruits have been eaten as green almond in spring. Taste of fruits is light bitter.

(ii) *Amygdalus turcomanica* (Figs 3 and 4): it has late flowering. The flowering of this species coincided to end of flowering period of *Amygdalus orientalis*. The trees are dwarf, the branches are quite thorny. The leaves are narrow, tall and hairless, and green coloured. Fruit yield is unsatisfactory and the nuts are dark brown. Because of very bitter taste, the fruits can not be eaten.



Fig. 1. The fruits of *Amygdalus orientalis*.



Fig. 2. The tree of *Amygdalus orientalis*.

Material and method

In this study, we used three types of *Amygdalus orientalis* and one type of *Amygdalus turcomanica* fruits which are collected around _anlıurfa. However, *A. webbii* fruits were used for comparison with these types fruits.

The evaluation and scoring for each characteristic based on the Descriptor List for Almond (IBPGR) is included in Table 1 (Gülcan *et al.*, 1990).



Fig. 3. The view of branch and fruits *Amygdalus turcomanica*.



Fig. 4. The tree of *Amygdalus turcomanica*.

Table 1. Evaluation and scoring for each characteristic

1. Ease of hulling	4. Nut shape	7. Softness of shell	10. Kernel pubescence
Low	1 Round	1 Extremely hard	3 Low
Intermediate	2 Ovate	3 Hard	5 Intermediate
High	3 Oblong	5 Intermediate	7 High
2. Ease of harvesting	4 Cordate	7 Soft	9 Extremely high
Low	5 Extremely narrow	9 Paper	11. Kernel taste
Intermediate	5. Shell colour intensity	8. Kernel colour intensity	3 Sweet
High	1 Extremely light	1 Extremely light	5 Intermediate
3. Nut size	3 Light	3 Light	7 Bitter
3 Small	5 Intermediate	5 Intermediate	12. Percentage of double kernel
5 Medium	7 Dark	7 Dark	The percentage of double kernels in a sample of 100 nuts
7 Large	6. Marking of outer shell	9 Extremely dark	
9 Extremely large	0 Without pores	9. Shrivelling of kernel	
	3 Sparsely pored	3 Slightly wrinkled	
	5 Intermediate	5 Intermediate	
	7 Densely pored	7 Wrinkled	
	9 Scribed		

Results and discussion

Selected important nut characteristics have been studied in the study. Obtained data has been given separately for each wild almond types in Tables 2, 3 and 4.

Table 2. Some nut characteristics of different wild almond types

Types	Ease of hulling	Ease of harvesting	Nut shape	Shell colour intensity	Marking of outer shell	Softness of shell
63 AO 01	Low	Intermediate	Extremely narrow	Intermediate	Without pores	Hard
63 AO 02	High	Low	Cordate	Intermediate	Without pores	Intermediate
63 AO 03	High	Intermediate	Oblong	Dark	Without pores	Intermediate
63 AT 01	Intermediate	Intermediate	Ovate	Extremely dark	Without pores	Intermediate
<i>A. webbii</i>	–	–	Ovate	Light	Sparsely pored	Extremely hard

Table 3. Some physical characteristics of different wild almond types

Types	Nut				Kernel				
	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Double kernel (%)
63 AO 01	14.31 c	8.07 d	1.17 d	0.40 d	10.84 d	10.84 d	4.60 d	4.97 d	17.14
63 AO 02	17.11 b	9.49 c	8.75 b	0.62 b	13.78 a	13.78 a	6.36 a	6.76 c	0.00
63 AO 03	14.58 c	9.57 c	8.31 c	0.53 c	12.22 b	12.22 b	5.92 b	6.91 c	0.00
63 AT 01	14.68 c	10.82 b	8.24 c	0.52 c	11.52 c	11.52 c	4.54 d	7.27 b	0.00
<i>A. webbii</i>	19.16 a	14.17 a	9.47 a	1.27 a	13.67 a	13.67 a	5.20 c	8.58 a	4.55
LSD _{5%}	0.53	0.48	0.29	0.06	0.45	0.45	0.24	0.27	–

Table 4. Some kernel characteristics of different wild almond types

Types	Kernel colour intensity	Shrivelling of kernel	Kernel pubescence	Kernel taste	Double kernel (%)
63 AO 01	Dark	Slightly wrinkled	Extremely high	Bitter	17.14
63 AO 02	Dark	Slightly wrinkled	High	Bitter	0.00
63 AO 03	Extremely dark	Intermediate	Extremely high	Bitter	0.00
63 AT 01	Intermediate	Wrinkled	Low	Extremely bitter	0.00
<i>A. webbii</i>	Light	Slightly Wrinkled	Low	Extremely Bitter	4.55

(i) Nut characteristics (Table 2).

- Ease of hulling: ease of hulling is an important characteristic for almonds. In these types, ease of hulling changed from low to high.
- Ease of harvesting: generally intermediate except for 63 AO 02.
- Nut size: nut size is also an important characteristic for almonds. According to obtained data, *A. webbii* has the largest nut and kernel size, and in weight; and 63 AO 01 has the smallest nut and kernel size, and in weight. The others have been measured between these two species (Table 3).
- Nut shape: nut shapes have differed between 3 types of *A. orientalis*. In *A. turcomanica* and *A. webbii*, the nut shape is ovate.

- Shell colour intensity: shell colour of 2 types of *A. orientalis* is intermediate and 1 type is dark. But the colour of *A. turcomanica* is extremely dark while *A. webbii*'s is light.
- Marking of outer shell: all types except *A. webbii* are without pores.
- Softness of shell: the types consisted of generally intermediate hard shell types. Softness of shell is hard and extremely hard in 63 AO 01 and *A. webbii*, respectively.

(ii) Kernel characteristics (Table 4).

- Kernel colour intensity: most of types in the populations have dark kernel colour. *A. webbii* is light.
- Shrivelling of kernel: most of the types have slightly wrinkled kernels.
- Kernel pubescence: in respect to kernel pubescence, types of *A. orientalis* are high and extremely high, while *A. turcomanica* and *A. webbii* are low.
- Kernel taste: all types of *A. orientalis* have bitter kernel taste. *A. turcomanica* and *A. webbii* are extremely bitter.
- Percentage of double kernel: the percentage of doubles ranged between 0 to 17.14% in the types. In two types of *A. orientalis* and in *A. turcomanica*, this value is 0%. As already known, low double kernel percentage is very important in almond breeding.

These species may be important for almond, peach, plum and apricot trees as rootstock in dry areas, because of resistance to drought conditions. According to our watches, trees of these types may also be resistant to *Capnodis* sp. It should be determined by entomologists in this point.

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