



# Investigation on the usage of hawthorn (*Crataegus* spp) as rootstock for loquat (*Eriobotrya japonica* Lindl.)

## Yenidünya (*Eriobotrya japonica* Lindl.) için anaç olarak alıç (*Crataegus* spp) kullanımının araştırılması

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### ABSTRACT

The aim of the study is to illuminate the possibilities of using of hawthorn (*Crataegus* spp) as rootstock in loquat (*Eriobotrya japonica* Lindl.) growing. For this aim, cv. Hafif Çukurgöbek (HÇG) was budded on the hawthorn rootstocks on 8<sup>th</sup> February, 18<sup>th</sup> May, 7<sup>th</sup> August, and 31<sup>st</sup> October 2019 with the chip budding method in the field conditions. The percent of bud-take successes were recorded after 45 days of the budding operations. In the bud-take, the top of the rootstock was cut from 10 cm above the budding point in order to sprout of the budding. After 15 days from this cutting, the ratio of bud-sprout was recorded. In addition, the bud shoot length and bud shoot diameter and also rootstock trunk diameter in all plants except dormant buddings were assigned in two different times on 24 December, 2019 and 8 February, 2020. The trial was planned in a completely randomized design with 6 replications and 10 plants per replication. Differences among means were analyzed by the Tukey's HSD method using SAS program. The highest values of bud take (47.6 %) and sprouting (70 %) rates were taken from budding done on 7<sup>th</sup> August, 2019. This was followed by 31<sup>st</sup> October, 2019 with 41.67 % bud take and bud sprout (% 21.43). The lowest budding success rate (10.58 %) was taken from the buddings which were done on 8<sup>th</sup> February, 2019. In both periods of measurement, budding done on 18<sup>th</sup> May 2019 yielded the higher values of bud shoot length and diameter. Preliminary results of this study show that hawthorn rootstock can be used in loquat cultivation.

**Key Words:** Budding success, Hawthorn, Loquat, Rootstock

### ÖZ

Bu çalışmanın amacı, yenidünya (*Eriobotrya japonica* Lindl.) yetiştiriciliğinde anaç olarak alıcın (*Crataegus* spp) kullanılması olanaklarını aydınlatmaktır. Bu amaçla, Hafif Çukurgöbek çeşidi, 8 Şubat, 18 Mayıs, 7 Ağustos ve 31 Ekim 2019 tarihlerinde alıç anaçlarına yonga aşı yöntemi ile bahçe koşullarında aşılanmıştır. Aşılamadan 45 gün sonra aşı tutma başarı yüzdesi kaydedilmiştir. Tutan aşıllarda, aşı gözünün sürmesi için aşı noktasının 10 cm yukarısından anacın tepesi kesilmiştir. Bu kesmeden 15 gün sonra, aşı sürme oranı belirlenmiştir. Ayrıca, durgun aşılar hariç tüm bitkilerde aşı sürgün uzunluğu ve sürgün çapı ile anaç gövde çapı 24 Aralık 2019 ve 8 Şubat 2020'de iki farklı zamanda ölçülmüştür. Deneme, Tesadüf Parselleri Deneme Desenine göre 6 yinelemeli ve her yinelemede 10 bitki olacak şekilde planlanmıştır. Ortalamalar arasındaki farklılıklar, SAS programı kullanılarak Tukey'in HSD yöntemi ile analiz edilmiştir. En yüksek aşı tutma (% 47,6) ve aşı sürme (% 70) oranları, 7 Ağustos 2019'da yapılan aşılamalardan alınmıştır. Bunu, % 41,67 aşı tutma ve % 21,43 aşı sürme oranları ile 31 Ekim 2019 izlemiştir. En düşük aşı başarı oranı (% 10.58) 8 Şubat 2019'da yapılan aşıllardan alınmıştır. Her iki ölçüm döneminde de 18 Mayıs 2019'da yapılan aşılar, daha yüksek aşı sürgün uzunluğu ve sürgün çapı değerleri vermiştir. Bu çalışmanın ön sonuçları, alıç anaçlarının yenidünya yetiştiriciliğinde kullanılabileceğini göstermektedir.

**Anahtar Kelimeler:** Aşı başarısı, Alıç, Yenidünya, Anaç

## Introduction

Loquat (*Eriobotrya japonica* Lindl.) is propagated mainly by budding method, and when it is budded mostly loquat seedling is used as rootstock. Loquat trees on the seedling rootstocks are very tall and large crowned. There are several difficulties of established an orchard with such large trees. First of all, the number of trees that can be planted per unit area is limited and also, operations such as pruning, spraying and fruit picking are difficult (Polat, 1995; Crane and Caldeira, 2006).

Researchers are conducted various experiments to solve these difficulties in loquat cultivation. The most important of these are the applications that reduce the tree's vegetative growth. The best solution for this is to use dwarf rootstocks (Polat and Kaşka, 1992 a, b). As a matter of fact, quince rootstocks are used as a dwarf rootstock in loquat cultivation (Lin, 2007; Hueso et al., 2007), although it is very limited.

There is some information in the literature that hawthorn can be used as rootstocks for loquat (Polat, 1995); however, there is not enough research done about this matter. It was not find any data about what is their success rates if loquat budded on the hawthorn rootstocks.

Only one study on the use of hawthorn rootstocks in loquat cultivation has been found in the literature. A study by Jamil et al., (2012) was carried out loquat was grafted on hawthorn trees grown naturally. Buddings were done onto wild hawthorn trees in three different periods (mid-

May, early June, and mid-June). In the study, the highest budding success was obtained budding done in mid-May 2010 (80.00%) and in mid-May 2009 (79.30%).

The goal of the current work was to determine the budding success in loquat cultivar/hawthorn rootstock combination and the vegetative growth behavior on this rootstock.

## Material and Method

This study was conducted during two growing sessions 2019 and 2020 in Antakya, Hatay, Turkey. Hafif Çukurgöbek cultivar was budded on the hawthorn rootstocks (Figure 1 a) on 8<sup>th</sup> February, 18<sup>th</sup> May, 7<sup>th</sup> August, and 31<sup>st</sup> October 2019 with the chip budding method in the field conditions. The trial was planned in a completely randomized design with 6 replications and 10 plants per replicate. The percent of bud-take successes were recorded after 45 days of the budding operations. In the bud-take, the top of the rootstock was cut from 10 cm above the budding point in order to sprout of the budding (Figure 1 b). After 15 days from this cutting, the ratio of bud-sprout was recorded. In addition, the bud shoot length and bud shoot diameter and also rootstock trunk diameter in all plants except dormant buddings were determined in two different times on 24 December, 2019 and 8 February, 2020. The data of the trial were analyses according to the completely randomized designed (Steel and Torrie, 1980) using SAS (2005). Differences among means were analyzed by the Tukey's HSD method.



Figure 1. a: Budding of hawthorn rootstocks with Hafif Çukurgöbek loquat cultivar and b: Cutting from 10 cm above the budding point.

## Results and Discussion

### Budding success

The data of bud-take and bud-sprout rates are presented in Figure 2 and 3. The highest bud take (47.6 %) and sprouting (70 %) rates were determined on 7th August, 2019. This was

followed by 31<sup>st</sup> October, 2019 with 41.67 % bud take and bud sprout (% 20). The lowest budding success rate (10.58 %) was taken from the buddings which were done on 8<sup>th</sup> February, 2019. The differences between the budding success rates of periods were found significant at  $P < 0.01$  (Figure 2 and 3).

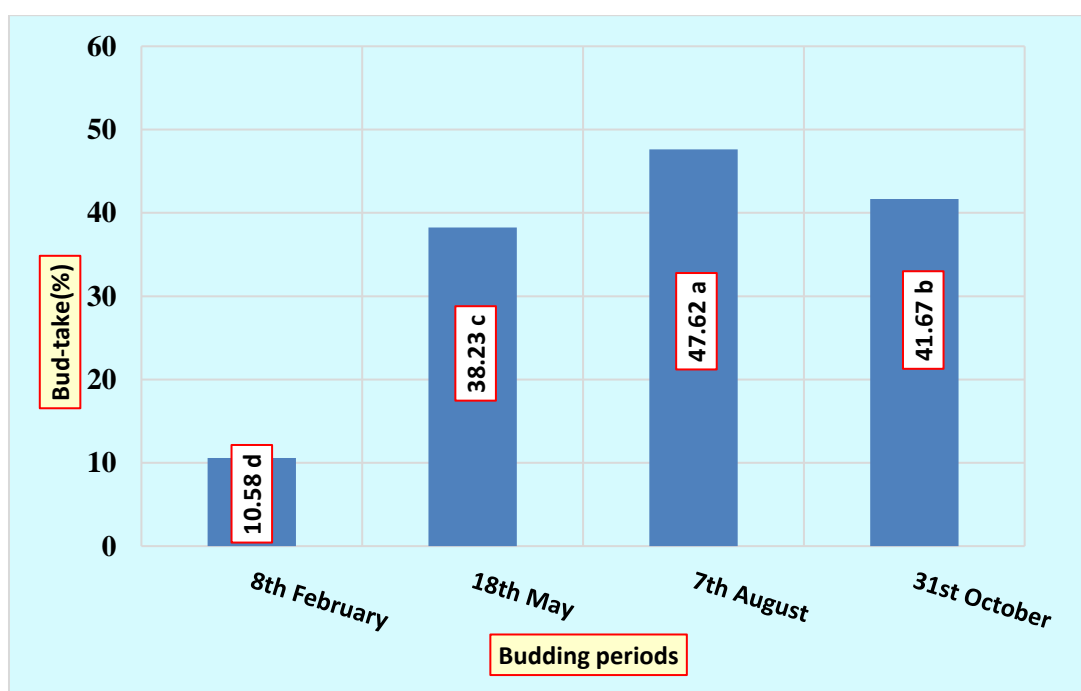


Figure 2. The bud-take rates of Hafif Çukurgöbek cultivar on the hawthorn rootstocks in different periods. <sup>(x)</sup>For each parameter different lowercase letters indicate significant difference by Tukey's test at 0.01

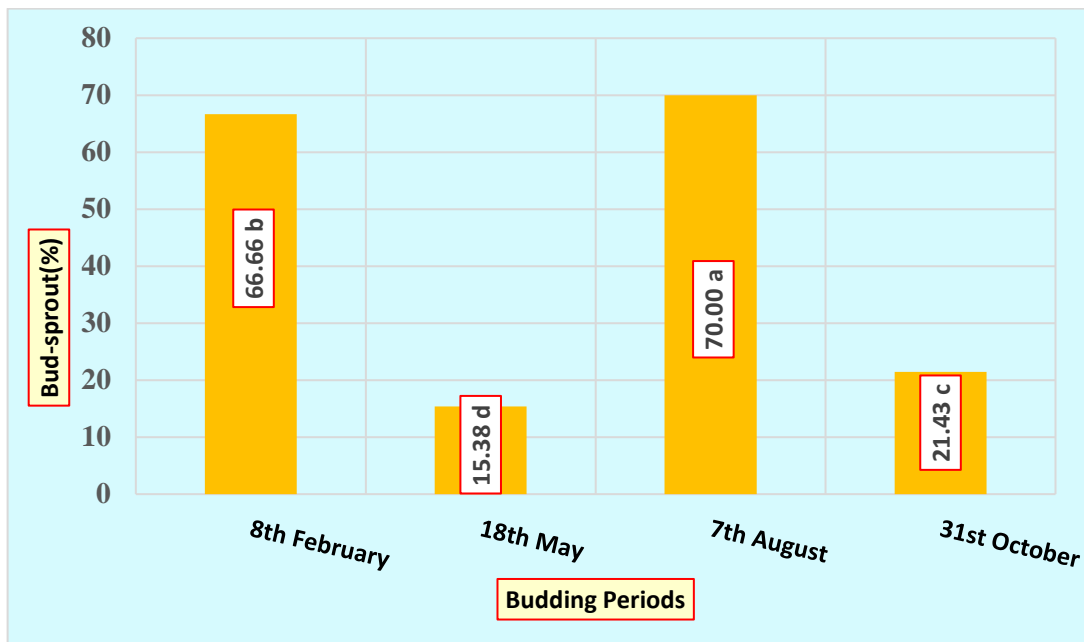


Figure 3. The bud-sprout rates of Hafif Çukurgöbek cultivar on the Hawthorn rootstocks in different periods. (x)For each parameter different lowercase letters indicate significant difference by Tukey's test at 0.01

Some factor such as different ecology, rootstock and cultivar characteristics, techniques of budding, and care after budding can affect to budding or grafting success rates (Polat, 2018). For these reasons, different results can be obtained from varies researches conducted in different ecological conditions with different species. Only one study on the use of hawthorn rootstocks in loquat cultivation has been found in the literature. In study by Jamil et al., (2012), the maximum budding success (80.00%) was taken from budding done in mid-May. Our budding success rates

(10.58%–47.62%) are lower than those of Jamil et al., (2012). Due to could not found enough literature for hawthorn rootstocks, it has been compared with some studies on quince rootstocks.

#### Vegetative trait

The graft shoot length, scion and rootstock trunk diameter are given in Table 1 and 2. In December 2019 measurements, the mean values of rootstock and scion diameter, and bud shoot length were measured as 15.04 mm, 5.38 mm and 12.60 cm, respectively (Table 1).

Tablo 1. The Vegetative Growth of "HÇG" Loquat Cultivar on Hawthorn Rootstock (December, 2019)

Budding periods	Stock diameter (mm)	Graft shoot diameter (mm)	Graft shoot length (cm)
8 <sup>th</sup> February, 2019,	15.39 a	4.78 b	11.55 b
18 <sup>th</sup> May, 2019	15.43 a	5.70 a	14.67 a
7 <sup>th</sup> August, 2019	14.29 b	5.66 a	11.57 b
Mean	15.04	5.38	12.60
Significance	*	**	**

(y) Different lowercase letters within a column are indicate significant difference by Tukey's test at 0.01 and 0.05.

In February measurements, these parameters were measured as 15.19 mm, 5.51 mm and 14.57 cm, respectively (Table 2). In both periods of measurement, the values of shoot length and diameter of budding done on 18th May 2019 was determined the higher than the other budding periods.

The budding periods had effect statistically significant on bud shoot diameter and length( $P<0.01$ ), and on stock diameter( $P<0.05$ ). The mean value of graft shoot length shows that the nurseries growth is very slow and the hawthorn rootstock reduces loquat growth.

Tablo 2. The Vegetative Growth of "HÇG" Loquat Cultivar on Hawthorn Rootstock (February, 2020)

Budding periods	Stock diameter (mm)	Bud shoot diameter (mm)	Bud shoot length (cm)
8 <sup>th</sup> February, 2019,	15.53 a	4.90 b	13.50 b
18 <sup>th</sup> May, 2019	15.61 a	5.83 a	17.00 a
7 <sup>th</sup> August, 2019	14.42 b	5.79 a	13.21 b
Mean	15.19	5.51	14.57
Significance	*	**	**

(v) Different lowercase letters within a column are indicate significant difference by Tukey's test at 0.01 and 0.05.

Our value of the bud shoot diameter and graft shoot length is lower than those of Jamil et al., (2012). In their studies, the highest shoot length value (19.3 cm) was determined in buddings on May 18, 2010, while the highest trunk diameter value (12.2 mm) was determined in buddings on May 18, 2009. This difference is expected. Because rootstocks in the study by Jamil et al., (2012) are 20-25 years old. The bud shoots on these rootstocks were growth more strongly.

## Conclusion

The budding success could be affected by several factors such as air or soil temperature, humidity, budding period, budding type, pest and disease (Kaşka and Yılmaz, 1974; Hartmann et al., 1990). In this study, the highest budding success rate (47.62%) was obtained with chip budding performed on 7<sup>th</sup> August, 2019. It was followed by 31<sup>st</sup> October, 2019 with 41.67 % bud take. From the results of this work, it is induced that in spite of the difference between growth habits of the two genera used in this study, hawthorn which is a deciduous tree and loquat which is an evergreen tree, there were no signs of graft incompatibility between them, since there was a good union between them from the first step of the study until after about two years.

It can be concluded that hawthorn which tolerates many environmental stresses such as drought and unfavorable soil conditions, can be used as a promising rootstock for loquat production either as a dwarfing rootstock for high density orchard plantation, or as a drought resistant rootstock for being exploited against ongoing drought condition nowadays all-over the world. Preliminary results of this study show that hawthorn rootstock can be used in loquat cultivation (Figure 4).



Figure 4. A loquat sapling on hawthorn rootstock.

Further work should be conducted to increase budding success rates on hawthorn rootstocks and also research should be continued to determine the effects on fruit quality using this rootstock.

**Author Contribution:** The AAP designed the study, set up the trials, conducted the study, analyzed the data and wrote the article.

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