



## Morphological and Phenological Characterization of the BDB-L Chestnut Genotype: A Promising Candidate for Nut Production and Pollination

BDB-L Kestane Genotipinin Morfolojik ve Fenolojik  
Karakterizasyonu: Meyve Üretimi ve Tozlayıcı  
için Umut Verici Bir Aday

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## MORPHOLOGICAL AND PHENOLOGICAL CHARACTERIZATION OF THE BDB-L CHESTNUT GENOTYPE: A PROMISING CANDIDATE FOR NUT PRODUCTION AND POLLINATION

### ABSTRACT

The BDB-L genotype, a hybrid chestnut derived from efforts to introduce the ‘Bouche de Bétizac’ cultivar to Türkiye. In this study, it was characterized morphologically and phenologically to evaluate its potential for nut production, pollination, and chestnut honey production. The study was conducted from 2020 to 2023 in Samsun, Türkiye. Examined key traits in this study are tree vigor, leaf morphology, catkin characteristics, bur structure, and nut quality. The genotype exhibited vigorous growth with a semi-upright habit, intermediate shoot thickness, and distinctive leaf traits, including attenuate tips, dot-shaped teeth, and a large leaf area. The male and mixed catkins displayed a spreading habit and longistaminate filaments, reflecting high pollination efficiency. The burs were large, squarely globular, and contained an average of 2.87 nuts, while the nuts were transverse ellipsoid in shape, with very bright pericarps, light cream kernels, and a thin, easy-to-peel seed coat. Notable nut characteristics included low seed penetration, low pericarp splitting (1.2%), and the absence of polyembryony, ensuring uniform kernel development. These traits align with market preferences for fresh consumption and processing, including confectionery applications. The phenological timeline revealed early bud burst and mid-season ripening, indicating adaptability to temperate climates. The findings suggest that the BDB-L genotype is a high-quality, versatile chestnut cultivar with significant potential for commercial nut production, pollination enhancement, and chestnut honey production.

**Keywords:** *Castanea* spp., Chestnut Cultivar, Chestnut Honey, Hybrid, Pollination.



## BDB-L KESTANE GENOTİPİNİN MORFOLOJİK VE FENOLOJİK KARAKTERİZASYONU: MEYVE ÜRETİMİ VE TOZLAYICI İÇİN UMUT VERİCİ BİR ADAY

### ÖZ

BDB-L, Türkiye’ye ‘Bouche de Bétizac’ çeşidini kazandırma çabaları sonucunda elde edilen bir hibrit kestane genotipidir. Bu çalışmada, BDB-L genotipinin morfolojik ve fenolojik özellikleri incelenerek, meyve üretimi, tozlayıcı karakteri ve kestane balı üretimi için potansiyeli değerlendirilmiştir. 2020-2023 yılları arasında Samsun, Türkiye’de gerçekleştirilen çalışmada; ağaç kuvveti, yaprak morfolojisi,

çiçek yapıları, kapsül yapısı ve meyve kalitesi gibi temel özellikler incelenmiştir. Genotip, yarı dik bir büyüme karakterine sahiptir. Güçlü bir büyüme karakterine sahip olan genotip, orta kalınlıkta sürgünler, sivri uçlu yapraklar ile nokta şekilli dişler ve geniş bir yaprak yüzeyi gibi ayırt edici yaprak özelliklerine sahiptir. Erkek ve karışık çiçek püskülleri, yoğun bir yapıya sahip olup, uzun erkek organ filamentleri ile yüksek tozlaşma verimliliği göstermiştir. Kapsüller, büyük, karemsi küresel şekilli olup kapsül içerisinde ortalama 2.87 adet meyve bulunmaktadır. Meyveler ise enine elipsoid şeklinde olup, çok parlak kabuklara, açık krem renkli iç kısımlara ve ince, kolay soyulabilen bir tohum kabuğuna sahiptir. Düşük tohum penetrasyonu ve kabuk çatlama oranı (%1.2) ile poliembriyoninin az oranda görülmesi gibi dikkat çekici özellikler, homojen bir iç gelişim sağlamıştır. Bu özellikler, taze tüketim ve şekerleme gibi uygulamalar için pazar tarafından tercih edilmektedir. Fenolojik zaman çizelgesi, erken tomurcuk patlaması ile orta mevsim olgunlaşmasını ortaya koymuş, bu da ılıman iklimlere adaptasyonunu göstermiştir. Bulgular, BD-B-L genotipinin ticari kestane üretimi, tozlayıcı çeşit olarak kullanımı ve kestane balı üretimi için önemli potansiyele sahip, yüksek kaliteli ve çok yönlü bir kestane genotipi olduğunu göstermektedir.

**Anahtar Kelimeler:** *Castanea* spp., Kestane Balı, Kestane Çeşitleri, Hibrit, Tozlaşma.



## INTRODUCTION

The *Castanea* genus includes economically and ecologically important tree species commonly known as chestnuts. They are naturally found primarily in temperate regions of the Northern Hemisphere. A total of 13 *Castanea* species are acknowledged, indigenous to the temperate areas of the Northern Hemisphere: five in East Asia, seven in North America, and one in Europe (Burnham et al., 1986; Soyulu, 2004). The most prominent species are *Castanea sativa* (European chestnut), *C. dentata* (American chestnut), *C. mollissima* (Chinese chestnut), and *C. crenata* (Japanese chestnut). Among these, *C. sativa* is widely distributed across Mediterranean and European countries. It's valued for both its high-quality timber and sweet and nutrient-rich nuts. On the other hand, in the USA, *C. dentata* was once a dominant species in North American forests until it was nearly eradicated in the early 20<sup>th</sup> century by chestnut blight caused by the fungus *Cryphonectria parasitica*.

Asian species, particularly *C. mollissima* and *C. crenata* play a crucial role in the global chestnut industry due to their resistance/tolerance to pests and diseases. After these diseases and pests increased, they were brought to Europe, and plantations were established. However, in the following years, these genotypes had low nut quality and high sensitivity to late spring frosts and failed to adapt to the ecologi-

cal conditions in some regions (Pereira-Lorenzo and Ramos-Cabrer, 2004). After these failed efforts, they were used in the breeding programs for *C. sativa*. Due to these species' low nut and timber quality, hybridization studies between European and Japanese chestnuts have been initiated in France, Portugal, and Spain (Pereira-Lorenzo et al., 2016). One successful breeding program in France aimed to obtain resistant cultivars to the root rot (*Phytophthora* spp) (Schad et al., 1952). As a result of the studies, *C. crenata* × *C. sativa* natural hybrids 'Bournette', 'Marigoule', 'Ferosacre', 'Marsol', 'Maraval' and 'Précoce Migoule' were obtained (Breisch, 1995; Breisch and Hennion, 2004). As a continuation of these studies, controlled crosses were continued. As a result of controlled crosses, 20.000 individuals were obtained, 6 of which were found promising as varieties and 30 as rootstocks. Among these six varieties, 'Bouche de Bétizac' is resistant to root rot and gall wasp and tolerant to chestnut blight (Pereira-Lorenzo et al., 2016). As 'Bouche de Bétizac' has a good nut quality, it became an excellent alternative for chestnut production.

After the invasion of the Asian gall wasp (*Dryocosmus kuriphilus* Yasumatsu, 1951) in Europe (Brussino et al., 2002), efforts were made to introduce the 'Bouche de Bétizac' cultivar to Türkiye. For these aims, it was reached out to some organizations in different countries. The scion woods were grafted and monitored in the controlled climate room. One of the scion woods, that were obtained from Lebanon as 'Bouche de Bétizac' was turned out that it was not actual cultivar. It looked like 'Bouche de Bétizac' and showed the properties of Euro x Japanese hybrid properties. However, it had many long catkins, and it was affected by the Asian chestnut gall wasp (Çil et al., 2022). It was understood that it was not the actual 'Bouche de Bétizac' cultivar. It was named as the BDB-L genotype.

This study aimed to identify the morphological and phenological properties of the BDB-L genotype. The registration studies are still going on with this genotype. It seems like a good alternative for chestnut honey production and pollination.

## MATERIAL AND METHOD

The study was conducted between 2020-2023 in Samsun, Türkiye. 6 plants were examined that were grafted on the seedlings of the BDB-L genotype at the Ali Nihat Chestnut research station in 2016 (41° 23' 53" N, 36° 03' 34" E, 535 m).

BDB-L genotype has been obtained through efforts to import 'Bouche de Bétizac' cultivar to Türkiye in 2012. It was sent from Lebanon as scion woods and labeled as BDB-L. Before shipping, scion woods were subjected to surface sterilization by using a fungicide containing Thiram 80%. Also, in Türkiye they were merged in sodium hypochlorite (1%) solution for 2 minutes (Akıllı Şimşek et al., 2021). The scion woods were firstly grafted on 'Marigoule' seedling to monitor for invasive pest and diseases (Figure 1).



**Figure 1.** BDB-L Genotype Grafted on 'Marigoule' Seedlings.

After making sure that the scion woods did not host any diseases and pests they were planted to the Ali Nihat research station. They were carefully examined and found out that they are not actual scion woods of the 'Bouche de Bétizac' cultivar. BDB-L genotype had long, and many catkins and it was susceptible to the Asian Chestnut Gall wasp (Figure 2) (Çil et al., 2022).



**Figure 2.** Male Catkins of the BDB-L Genotype.

To better understand the characteristics of this genotype, it was grafted on their own seedlings and planted in the same orchard in 2016. For this aim phenological and morphological properties of BDB-L genotype were examined between 2020 and 2023. The vigor and development patterns of the tree were assessed by measuring its height, crown width, and the area covered by the crown after the leaf fall (Bounous et al., 2018; Kotobuki, 1996; UPOV, 2024). The shoot density and color were assessed in accordance with Kotobuki (1996) and Bounous et al. (2018). Thickness of the lateral shoot was examined in the dormant period. For this aim 10 shoots were selected and measured in March. Also, in these shoots length of the internodes and lenticel density were measured (Kotobuki, 1996; UPOV, 2024). Lenticel density was measured between 3<sup>rd</sup> and 5<sup>th</sup> internodes. According to Bounous et al. (2018), bud length, width and color are also descriptive characteristics for chestnuts. Additionally, presence of anthocyanin in the young shoots were determined by visually (Bounous et al., 2018). The phenological stages of the BDB-L genotype were determined by monitoring key events, including the timing of bud burst, the beginning of male catkin blooming, full bloom, the end of male catkin blooming, the start and end of female catkin blooming, the ripening period, and leaf fall. Leaf characteristics were determined by collecting the leaves from the fifth to the seventh nodes of well-developed lateral shoots during the last week of July each year. Fifteen leaves were taken from each tree. Leaf characteristics were evaluated to assess morphological and anatomical traits. Measurements included the shape of the leaf tip, shape of teeth, leaf area (cm<sup>2</sup>), lamina width (cm), lamina length (cm), leaf length (cm), and petiole length (mm). Additionally, petiole thickness (mm) was recorded. Ratios of lamina length to lamina width, lamina width to leaf length, teeth width to teeth length, and lamina length to petiole length were calculated. Phyllotaxy, the shape of the leaf end, and bronze coloration on young leaves were also examined. Observations included the green color of the upper leaf surface, subsurface color, and petiole color. The cross-section of the leaf, the number of veins on the left side, as well as the length and width of the teeth, were measured. Flower characteristics were assessed to evaluate the reproductive structures of the plants. Observations included the habit of male catkins and measurements of the stamen filament length in male catkins (mm). Additionally, the lengths of male catkins (cm) and mixed catkins (cm) were recorded. Bur characteristics were analyzed to evaluate the physical and morphological traits. Parameters recorded included the shape of the bur, bur length, width, and height, as well as the width-to-length ratio. The length of spines (mm) and spine density (number per cm<sup>2</sup>) were measured. The size of the bur was calculated by combining its dimensional data, while the number of nuts per bur was also recorded. Additionally, the thickness of the spines was evaluated to provide further insights into bur morphology. Nut characteristics were assessed to evaluate the physical, morphological, and quality-related traits. Parameters observed included nut shape, the relative size of the hilum in relation to the nut, and the brightness and color of the pericarp. The density of tomenta on



the nut tip and the percentage of chestnuts with a split pericarp were also recorded. Nut size and kernel color were measured, along with the ease of peeling the seed coat in fresh nuts and the degree of seed coat penetration into the embryo (UPOV, 2024). Polyembryony (%) and sweetness levels were evaluated to provide additional insights into nut quality. Hilum size, hilum shape, and the presence of nut stripes were analyzed, and the shell thickness was measured to complete the characterization process (Kotobuki, 1996; Serdar et al., 2011; UPOV, 2024).

## RESULTS AND DISCUSSION

The BDB-L genotype demonstrated a comprehensive range of morphological and phenological characteristics. It exhibited very vigorous growth, characterized by a semi-upright growth habit, like the vigor observed in established cultivars like ‘Serdar’ and ‘Marigoule’ (Serdar et al., 2011) (Figure 3). On the other hand, ‘Bouche de Bétizac’ cultivar shows an erect to very erect growing character (INRA, 1998; Kumru, 2019; Revord et al., 2021).



**Figure 3.** Tree Canopy and Vigor of the BDB-L Genotype.

**Table 1.** Morphological and Phenological Characteristics of the BDB-L Genotype.

Descriptor Name	BDB-L
<b>Tree and shoot characteristics</b>	
Tree Vigor	Very Vigorous
Growth Habit	Semi-upright
Shoot Density	Low
Color of Shoot	Reddish Brown
Thickness of Lateral Shoot (mm)	Intermediate (5.89)
Length of Internodes of Lateral Shoot (mm)	Intermediate (30.6)
Lenticel Density of Lateral Shoot (no. per cm <sup>2</sup> )	Sparse (15.86)
Bud Length (mm)	4.14
Bud Width (mm)	3.97
Bud Length / Bud Width	0.96
Bud Color	Reddish Green
Anthocyanin in the Shoot	Exist
<b>Phenological characteristics</b>	
Time of Bud Burst	10-14 April
Beginning to Bloom of Male Catkins	15-21 June
Full Blooming of Male Catkins	19-27 June
Ending to Bloom of Male Catkins	26 June-6 July
Beginning to Bloom of Female Catkins	14-16 June
Ending to Bloom of Female Catkins	30 June - 2 July
Ripening Time	28 September-2 October
Time of Leaf Fall	1-10 December
<b>Leaf characteristics</b>	
Shape of Leaf Tip	Attenuate
Shape of Leaf Teeth	Dot
Leaf Area (cm <sup>2</sup> )	Small (85.3)
Lamina Width (cm)	Intermediate (5.66)
Lamina Length (cm)	Intermediate (21.41)
Leaf Length (cm)	Intermediate (23.80)

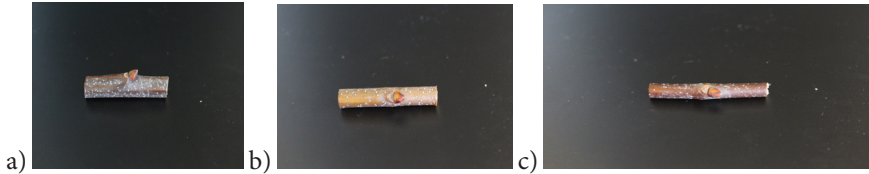


Petiole Length (cm)	Intermediate (2.39)
Petiole thickness (mm)	1.94
Ratio of Lamina Length/Lamina Width	3.78
Ratio of Lamina Width/Leaf Length	0.23
Ratio of Teeth Width/Length	0.57
Ratio of Lamina Length/Petiole Length	8.95
Phyllotaxy	2/5
Shape of Leaf End	Hearth
Bronze Coloration on Young Leaf	No
Green Color on the Upper Surface	Medium
Subsurface Color	Light Green
Leaf Petiole Color	Yellow
Cross Section of Leaf	Slightly Concave
Leaf Veins on the Left Side	25.47
Leaf Teeth Length	2.61
Leaf Teeth Width	1.49
<b>Flower characteristics</b>	
Habit of Male Catkin	Spreading
Length of Stamen Filament in Male Catkin (mm)	Longistaminate (7.12)
Length of Male Catkin (cm)	Long (25.67)
Length of Mixed Catkin (cm)	Long (13.60)
<b>Bur characteristics</b>	
Shape of Bur	Squarely globular
Bur Length	66.17
Bur Width	70.97
Bur Height	71.05
Bur Width/Length	1.07
Length of Spine (mm)	Short (15.08)
Density of Spines (number. per cm <sup>2</sup> )	Low (142)
Size of bur	Large
Nut Number in a Bur	2.87

Spine Thickness	0.20
<b>Nut characteristics</b>	
Nut Shape	Transverse Ellipsoid
Relative Size of Hilum in Relation to Nut	Large (0.81)
Brightness of Pericarp	Very Bright
Color of Pericarp	Light Brown
Density of Tomenta on Nut Tip	Low
Chestnuts With a Split Pericarp (%)	Low (1.2)
Nut Size	Very Big (57 nuts/kg)
Color of Kernel	Light cream
Peeling of Seed Coat in Fresh Nut	Easy
Penetration of Seed Coat into the Embryo	Weak Penetration
Polyembryony (%)	Absent (1.8)
Sweetness	Tasteful
Hilum Size (mm <sup>2</sup> )	Large (646)
Shape of Hilum	Elliptical Broad
Nut Stripes	Exist
Shell Thickness	0.867

The shoot density was categorized as low, while the shoots displayed a reddish-brown color, which aligns with typical traits of ‘Marigoule’ (Serdar et al., 2011). However, “Bouche de Bétizac’ cultivar has yellowish-brown shoots that makes it easier to identify these plants (Figure 4) (INRA, 1998; Breish, 1995). The lateral shoot thickness was measured as intermediate (5.89 mm), slightly greater than ‘Serdar’ (5.28 mm) but marginally less than ‘Marigoule’ (5.59 mm). It aligns more closely with the intermediate characteristics observed in other chestnut genotypes studied in the Central Black Sea Region (Serdar and Soylu, 1999). In the ‘Bouche de Bétizac’ cultivar Kumru (2019) measured the length of the internodes of the lateral shoot (mm) as 43.9 mm in 2015 and 43.7 mm in 2016. On the other hand, BDB-L genotype had much more short internode distance compared to the ‘Bouche de Bétizac’ cultivar (30.6 mm). Lenticel density of lateral shoot is an essential descriptive characteristic located in both UPOV (2024), Kotobuki (1996) and Bounous et al. (2018). BDB-L genotypes had intense lenticel density between 3<sup>rd</sup> and 5<sup>th</sup> internodes (15.86 cm<sup>-2</sup>), which is sparse compared to other cultivars and genotypes. ‘Marigoule’ has (29.00 cm<sup>-2</sup>) and ‘Serdar’ had (34.2 cm<sup>-2</sup>) lenticel density on their lateral shoots. Bud characteristics are useful traits for cultivar discrimination

(Bounous et al., 2018). In BDB-L genotype, bud length was measured as 4.14 mm while width was 3.97 mm. The ratio between them was calculated as 0.96. BDB-L had reddish green bud color, that is similar with the 'Bouche de Bétizac' and 'Marigoule' cultivars (Figure 4) (Riondato et al., 2020; Serdar et al., 2011). Also, anthocyanin in the young shoots existed in the BDB-L genotype.



**Figure 4.** Comparison of Bud Characteristics in a) BDB-L, b) 'Bouche de Bétizac', and c) 'Marigoule' Cultivars.

Phenological stages can be influenced by the ecological conditions of the year and the location of the orchard. The phenological stages of the BDB-L genotype were closely monitored to evaluate its growth cycle. The time of leaf bud burst occurred between 10–14 April, indicating a late onset of vegetative growth. The male catkins began blooming between 15–21 June, reaching maximum blooming between 19–27 June, and concluded by 26 June–6 July. Similarly, the female catkins began blooming between 14–16 June, with their blooming period ending by 30 June–2 July. The ripening period was observed from 28 September to 2 October, indicating a mid-season maturity for nuts. Finally, the time of leaf fall occurred late in the season, between 1–10 December, which reflects the extended vegetative period. On the other, Serdar et al. (2011) indicated that in 'Marigoule' cultivar bud burst was 8 days earlier than BDB-L genotype. However, Serdar et al. (2011) established their study at a different place (Fatsa/Ordu), which has a completely different ecological condition. Besides, 'Marigoule' plants in the experimental orchard showed a similar phenological stages compared to BDB-L genotype.

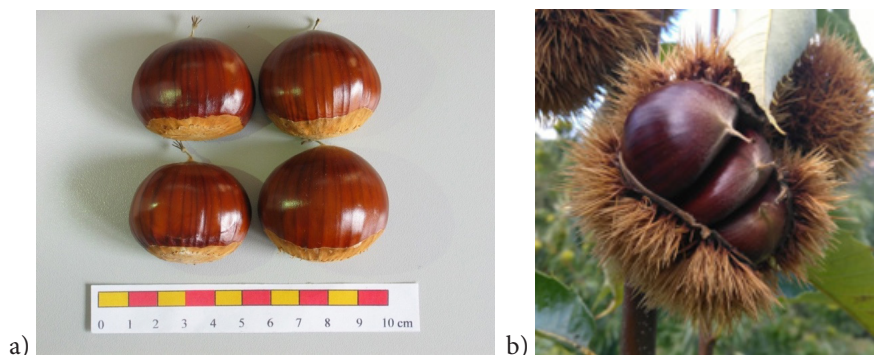
The leaves of the BDB-L genotype exhibit a distinctive combination of morphological characteristics. The leaf tip is attenuate, and the teeth are described as dot-shaped, with a teeth width-to-length ratio of 0.57. The overall leaf area is 85.3 cm<sup>2</sup>, with a lamina width of 5.66 cm and a lamina length of 21.41 cm, resulting in a lamina length-to-width ratio of 3.78. The total leaf length measures 23.8 cm, while the petiole length is 2.39 cm, giving a lamina length-to-petiole length ratio of 8.95. Phyllotaxy follows a 2/5 arrangement, and the leaf end is heart shaped. The leaves lack bronze coloration on young foliage, while the upper surface displays a medium green color and the subsurface is light green. The petiole is yellow, and the cross-section of the leaf is slightly concave. Additionally, the leaves have an average of 25.47 veins on the left side, with teeth measuring 2.61 mm in length and 1.49 mm in width. Leaf traits of the BDB-L genotype closely resemble those observed

in Nazilli chestnut accessions, which displayed variability that correlates with genetic diversity and environmental adaptability (Ertan, 2007). These traits are also comparable to the broader morphological diversity reported by (Pérez and López, 2009), where similar dimensions were noted among chestnut cultivars.

The male catkins of the BDB-L genotype exhibit a spreading growth habit (Bounous et al., 2018; UPOV, 2024), indicating a wide distribution of reproductive structures, which may enhance pollination efficiency. The spreading habit of male catkins in BDB-L mirrors traits described in Slovenian and Piedmont chestnut populations, where adaptability and reproductive efficiency were emphasized due to similar environmental conditions (Solar et al., 2005). The stamen filaments are classified as longistaminate, with an average length of 7.12 mm, a trait associated with improved pollen dispersal. The longistaminate stamen filaments (7.12 mm) of BDB-L are comparable to those of elite Spanish and Italian cultivars studied for high pollination potential (Pereira-Lorenzo et al., 2006). The male catkins measure 25.67 cm in length, suggesting robust and well-developed reproductive structures, while the mixed catkins, combining male and female reproductive components, measure 13.60 cm in length. These lengths align with values documented for robust cultivars like 'Serdar', 'Erfelek', 'Ünal' and selections from Piedmont, which have been noted for their contributions to reproductive fitness and nut production (Serdar et al., 2011; Serdar et al., 2013; Torello Marinoni et al., 2013). These dimensions highlight the reproductive vigor of the BDB-L genotype, making it a strong candidate for effective pollination and nut production. This is the one of the main differences between 'Bouche de Bétizac' cultivar and BDB-L genotype. 'Bouche de Bétizac' cultivar is a male sterile (Breish, 1995). Average length of the male catkin of the 'Bouche de Bétizac' cultivar is between 18 to 20 cm that is shorter than BDB-L genotype (INRA, 1998; Breish, 1995). On the other hand, BDB-L genotype produces lots of pollens and it's a good alternative as a pollinator.

The burs of the BDB-L genotype are squarely globular in shape, with a large size indicative of substantial nut development. The dimensions include a bur length of 66.17 mm, a width of 70.97 mm, and a height of 71.05 mm, resulting in a width-to-length ratio of 1.07. The spines are classified as short, averaging 15.08 mm, which is shorter compared to some cultivars in Piedmont and Slovenia that exhibit longer spines for enhanced pest protection (Solar et al., 2005; Torello Marinoni et al., 2013). The spine density, recorded at 142 spines per cm<sup>2</sup>, is relatively low compared to the high-density burs observed in pest-resistant cultivars such as 'Serdar', which can exceed 200 spines per cm<sup>2</sup> (Serdar et al., 2011). The burs typically contain an average of 2.87 nuts, reflecting efficient nut development. Which is slightly higher than many Mediterranean and Slovenian cultivars (average around 2.5 nuts per bur) (Solar et al., 2005). Additionally, the spine thickness is measured as 0.20 mm.

The nuts of the BDB-L genotype exhibit a transverse ellipsoid shape with a large hilum size, constituting 0.81 of the nut's dimensions, and a broad elliptical form (Figure 5). Color of the nut is light brown and very bright in BDB-L genotype. Besides, in the 'Bouche de Bétizac' cultivar color of the nut is reddish-brown (quickly turning brown after harvest) and medium gloss (Poljak et al., 2021). Also, tomentum density is visually higher in the 'Bouche de Bétizac' cultivar than BDB-L genotype (Figure 5).



**Figure 5.** Nuts of the a) BDB-L Genotype and b) 'Bouche de Bétizac' cultivar.

In the studies conducted in Piedmont and Slovenia, they linked the transverse ellipsoid shape as one of the market preferences (Solar et al., 2005; Torello Marinoni et al., 2013). The pericarp is light brown with a very bright appearance. This trait is commonly observed in premium chestnut cultivars like 'Marrone'cultivars (Torello Marinoni et al., 2013). The density of tomenta on the nut tip is low, and the percentage of chestnuts with a split pericarp is minimal, recorded at 1.2%. This trait indicates excellent nut quality and low post-harvest losses. The nuts are categorized as very large, with an average weight corresponding to 57 nuts per kilogram, aligning with premium nut size standards in commercial chestnut production. Also, it surpasses many cultivars evaluated in different studies (Ertan, 2007; Serdar et al., 2011; Serdar et al., 2013; Solar et al., 2005; Torello Marinoni et al., 2013). The kernel is light cream in color and the seed coat is easy to peel, traits that are highly desirable for fresh consumption and processing. The seed coat penetration into the embryo is weak. It is a very important trait for products like chestnut candy. Pol-yembryony is absent in the genotype, ensuring uniform kernel development, a critical trait for commercial production and processing (Solar et al., 2005). The nuts are also characterized by their tasteful sweetness and the presence of nut stripes. The shell thickness is measured at 0.867 mm, which provides adequate protection.

## CONCLUSION

The BDB-L genotype demonstrated a unique combination of morphological and phenological characteristics, making it a promising candidate for chestnut production. The genotype exhibits vigorous tree growth with semi-upright habits and robust leaf morphology. Although the ‘Bouche de Bétizac’ cultivar and the BDB-L genotype share similar characteristics, there are significant differences in critical traits such as male catkin morphology and fruit shape. BDB-L genotype differs from the ‘Bouche de Bétizac’ cultivar by having longistaminate male catkins with a spreading flowering habit, resulting in high pollination efficiency. This trait makes it as a perfect candidate for chestnut honey production. Additionally, the fruits of the BDB-L genotype are transversely ellipsoid in shape, with a very bright pericarp and a thin, easily peelable seed coat, whereas the ‘Bouche de Bétizac’ cultivars produce more triangular-shaped nuts with a darker-colored pericarp.

The nuts of BDB-L genotype exhibit premium market traits. The findings in this paper underscore BDB-L’s potential as a high-quality, versatile cultivar suitable for commercial chestnut production, fresh markets, and specialty confectionery applications.

### Conflict of Interest

The author declares no conflict of interest.

### Ethics

This study does not require ethics committee approval.

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