The PDO and PGI table olives of Spain

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Keywords: table olives, Manzanilla, Gordal, Aloreña, Mallorquina

Abstract

This article gives an overview of the current use of the European system of protected designation of origin (PDO) and protected geographical indication (PGI) for Spanish table olives. To date, there have been two PDOs recognized by the European Commission, the PDO "Aceituna Aloreña de Málaga" (2012) and the PDO "Aceituna de Mallorca/Mallorquina" (2014). In both cases, olives are debittered in brine without the use of alkali, although they may be crushed to accelerate the process. Therefore, they can be sold as natural olives according to the standards of the International Olive Council. Moreover, most of these protected olives are seasoned with fennel, garlic, pepper and thyme. However, the production of these protected olives is very low. In fact, they represent less than 1% of the total Spanish production of table olives. Nevertheless, the new PGI "Aceituna Manzanilla Sevillana/Aceituna Gordal Sevillana" could significantly increase the production of Spanish protected olives in the near future as its application is in its final phase. These are olives elaborated following the Spanish style and have been highly esteemed by consumers for centuries.

Practical applications: The European system of PDO and PGI tries to protect farmers and processors against faked imitations of agricultural products intended for human consumption. Although it has not been used extensively by Spanish table olive processors, this protection system could help farmers to valorize their table olives in future.

1 Introduction

Global production of table olives is estimated to be approximately 2.9 million tons for the season 2017/2018, Spain being the main producing country with around 20% of the total, more than half of which is exported to numerous countries [1]. In fact, millions of tons of Spanish-style green olives of the Manzanilla and Gordal/Sevillana cultivars have been exported to the USA from the beginning of the 20th century [2].

Many olive cultivars are processed as table olives in Spain, although most of them are locally produced for domestic consumption, and only a few are of economic importance. Among them, Hojiblanca, Manzanilla, Carrasqueña, Gordal and Cacereña represent more than 95% of national production [3], which are mainly intended for Spanish-style green olives and black ripe olives or oxidized black olives. By contrast, minor olive cultivars such as Empeltre, Aloreña, Verdial, Cornezuelo and Arbequina are currently elaborated as natural green or black olives.

Although Spanish table olives have been elaborated and exported to many countries for centuries, it has not been until recent years that producers have come together to create table olives protected under European law. Unlike other table olive producing countries such as Greece, Portugal, France and Italy (Table 1), there are only two Protected Designation of Origin (PDO) and one Protected Geographical Indication (PGI) of table olives in Spain. The reason for this low number of protected Spanish table olives is likely to be related to the size of the olive companies. Large companies have not been interested in these quality figures, whereas small companies have found them to be a good tool for the valorization of their products.

The objective of this study is to give an overview of the two Protected Designation of Origin (PDO) table olives implemented in Spain, as well as the Protected Geographical Indication (PGI) table olives in process.

2 PDO “Aceituna Aloreña de Málaga”

This was the first Spanish PDO of table olives recognized by the European Commission in 2012 [4]. The production zone of Aloreña olives is located in the south-east of the

province of Málaga (Figure 1) and includes a total of 19 municipalities within the geographical area known as "Sierra de las Nieves and Valle del Guadalhorce" [5]. The olive trees are cultivated in dry zones on the slopes of hills and mountains that surround the Guadalhorce Valley, with moderate winters and hot summers. The annual production of Aloreña olives dedicated to table olives ranges between 2,000-4,000 tons due to the bearing of the olive trees. Hence, it is not a very high production in comparison with the total Spanish production of table olives. However, these olives are very much appreciated by local consumers and, nowadays, by the whole country. Its logo is depicted in Figure 2.

The Aloreña olives are harvested by hand with a green or green-yellow colour on the surface. They are appreciated because of their high flesh-stone ratio, with easy removal of their stone from the flesh during the crushing step, and their crunchy texture. This is a sweet cultivar due to its low content in the bitter glucoside oleuropein (<2000 mg/kg, 5-7 times lower than in Manzanilla olives) [6] that, once processed, can be seasoned with thyme, fennel, garlic and pepper. In addition, only large olives ranging between 140-260 olives per kg can be marketed as protected Aloreña olives.

There are three olive products protected under the PDO "Aceitunas Aloreñas de Málaga" (Figure 3): (i) fresh green, (ii) traditional, and (iii) cured.

"Aceituna Aloreña de Málaga" fresh green

Harvested olives are currently crushed and put into small barrels where they are covered with a brine of 7-11% NaCl (w/v) and maintained under refrigeration below 8ºC. At least three days are needed to diminish the bitterness of the fruit and after this period, the product can be seasoned and packed. The shelf-life of the product is short, despite it being possible to add preservatives such as benzoic and sorbic salts. These olives have a light green colour, a very pleasant smell reminiscent of green fruit and grass, a crunchy texture and a slightly bitter taste [7].

"Aceituna Aloreña de Málaga" traditional

Similarly to "fresh green" olives, they are crushed, put into small barrels and covered with brine (7-11% NaCl, w/v). Then, they are stored at ambient temperature for at least 20 days before seasoning and packing. They can be maintained under these conditions during the whole winter before they change to the cured state with the

increasing temperatures in the spring season. These olives have a green-pale yellow colour, and their smell evokes fresh fruit and the typical seasoning, rather than the fresh grassy notes of "fresh green olives". In addition, they have a slightly crisp texture and bitterness [7].

"Aceituna Aloreña de Málaga" cured

In this process, olives are introduced into big fiberglass tanks (16,000 L capacity) without any previous crushing step. The fruit are covered with brine (6-8% NaCl, w/v) which is acidified with acetic acid (0.5-0.8%, w/v). Due to the low content of oleuropein in this cultivar, spontaneous lactic acid fermentation can take place in brine during the preservation of the olives [6, 8], together with the growth of yeasts [9]. Over the course of a year, the olives are taken out of the tanks, crushed, seasoned and packed. It is well-known that chemical and enzymatic oxidation of phenolic compounds in natural olives give rise to darkening of the fruit, so aeration of the olives is avoided by processors, as well as pasteurization, that accelerates these reactions [10]. Hence, the shelf-life of the product is assured by the chemical conditions of the brines, reinforced by the addition of preservatives. The final product has a lactic odour and an acidic taste, and the texture is less firm and crisp than that of "fresh green" and "traditional" olives.

3 PDO "Aceituna de Mallorca/Aceituna Mallorquina/Oliva de Mallorca/Oliva Mallorquina"

This was the second Spanish PDO of table olives recognized by the European Commission in 2014 [11]. The geographical area covers the entire island of Mallorca (Balearic Islands, Spain) (Figure 1), although most of the farms are located in the north of the island. Olive trees are mostly cultivated on terraces, facing south to avoid cold winds from the north, and the only water supplied is rainwater [12]. The annual production of table olives in the Balearic Islands ranges from around 50-170 tons per year, but the protected Mallorca olives is only around 10-20 tons per year, which are consumed locally. Its logo is depicted in Figure 2.

The Mallorca olive is a specific cultivar of the Mallorca island, although it has similar characteristics to the Empeltre cultivar. They are harvested by hand in two different stages of maturation, with a green/yellow or black colour on the surface. This

is a medium-sized (2-4 g per fruit) and asymmetrical fruit with a low flesh-stone ratio (around 5.3), and a barely attached flesh to the stone. Moreover, consumers appreciate very much these olives because of their bitterness.

There are three products protected under the PDO "Aceituna de Mallorca" [12], (i) whole green olives, (ii) cracked green olives, and (iii) whole black olives. Harvested green and black olives are washed, graded by size and covered with a brine (> 6% NaCl) where they remain for at least two to three months before packing, which is the time needed to lose most of their bitterness. Fermented olives are packed in new brine which may be acidified with citric acid to drop the pH below 4.3 units. In addition, olive oil is currently added to the packed olives with black colour.

Regarding cracked olives, they are harvested green and immediately transported to the factories where they are washed, cracked and put in brine (> 6% NaCl) spiked with fennel and chilli peppers. After a minimum of 40 days, the fruits are packed in new brine spiced with fennel and chilli pepper, that may be spiked with citric acid to maintain the pH below 4.3 units.

All these products are consumed locally and are appreciated for their flavour balance between acid, salty and bitter sensations, besides the unctuous sensation provoked in the mouth.

4 PGI "Aceituna Manzanilla de Sevilla/Aceituna Manzanilla Sevillana" and "Aceituna Gordal de Sevilla/Aceituna Gordal Sevillana"

Several farming cooperatives and table olive companies founded a table olive association in 2014 (APAS) dedicated to the valorization of the Manzanilla and Gordal cultivars grown in the Seville province (south of Spain). This association promoted the legalization of a Protected Geographical Indication of these olives, thereby the Andalusia Regional Government and the Spanish Government approved this PGI in 2016 [13]. Hence, an application for this PGI was sent to the European Commission which is now in its final stage. It must be noted that several Spanish table olive associations and companies have opposed this PGI but their lawsuits have been rejected until now.

Figure 4 shows the annual production of Spanish Manzanilla and Gordal cultivars during the last crops, which reflects a rather constant production of the two cultivars with around 150,000 and 40,000 tons of the Manzanilla and Gordal respectively [3]. These figures mean that the protected olives could reach around 30-40% of the total table olive Spanish production, although the APAS association only produces around 50,000-60,000 tons of these Spanish Manzanilla and Gordal olives.

Indeed, olive trees of both cultivars are grown worldwide because of the excellent characteristics of the fruits for processing as table olives. Manzanilla olives are very highly esteemed by table olive processors due to their round shape, small stone, medium size, thin skin and high flesh-stone ratio [14]. In fact, the round shape and the high flesh-stone ratio are two parameters of great importance for the pitting step needed for most of the commercial product. Among the Spanish olive cultivars intended for table olives, the Manzanilla has a very high concentration in phenolic compounds, particularly the bitter glucoside oleuropein (8000-20000 mg/kg) [15], which encouraged processors to look for ways to debitter the fruit. Hence, the alkaline treatment of olives and further lactic acid fermentation gave rise to the Spanish-style green olives, whose production on an industrial scale began at the end of the 19th century near Seville (south of Spain) [2]. It must be noted that the PGI "Aceituna Manzanilla and Gordal de Sevilla" protects olives cultivated in the Seville province and three towns of the Huelva province (Figure 1).

Regarding the Gordal olives, this is a very much appreciated cultivar due to its large size and high flesh-stone ratio [14, 16]. It is a sweet cultivar with a low content of oleuropein (1000-4000 mg/kg) [15] although it is also processed following the Spanish style. Hence, the PGI protected Manzanilla and Gordal olives must be elaborated as Spanish-style green olives (Figure 5) [13].

Manzanilla and Gordal olives have traditionally been picked by hand, but the availability of new harvesting machines has encouraged scientists and farmers to look for mechanical harvesting of these fruits. However, these two olive cultivars are very prone to bruising, with the formation of brown spots on olives, which has limited the use of this technique [17]. Mechanical harvesters produce brown spots on the olive surface and mesocarp as a consequence of the enzymatic oxidation of oleuropein [18] that makes the final product uncommercial. Therefore, in order to obtain high quality

olives, one requirement of the protected Manzanilla and Gordal olives is to perform the harvesting by hand.

After harvesting, olives are transported to the table olive factories where leaves are removed together with small sized fruits. Subsequently, the olives are covered with a NaOH solution (lye) (1.8-2.2 % w/v) for 6-10 hours at ambient temperature, but it has been common practice to store these two olive cultivars at ambient temperature at least for 24 hours before the alkaline treatment to avoid blistering in the final product. Obviously, the fruit continues respiration after harvesting with loss of humidity and texture that may influence the adhesion of the skin to the rest of the pulp [19]. However, the use of cold alkali to prevent blistering is increasing, instead of the storage period.

The lye is removed, and the olives are washed for several hours followed by the immersion of the fruit in brine, where spontaneous lactic acid fermentation takes place, which is commonly more intense in brines of the Gordal olives than Manzanilla due to the lower content in phenolic compounds of the former cultivar [20].

At the end of the elaboration process, olives have a golden yellow colour, a fine texture and are not fibrous, and a unique aroma and flavour. In addition, only olives of extra and first categories [21], and those Manzanilla with a size between 141/166 and 321/350 olives per kilogram and Gordal with a size between 60/70 and 121/140 olives per kilogram can be marketed with the PGI logo (Figure 2).

5 Conclusions

Although Spain is the main producing and exporting country of table olives, there have been only two PDOs recognized by the European Commission up to now, “Aceituna Aloreñas de Málaga” and “Aceituna de Mallorca”. In both cases, protected olives are not treated with alkali thereby they are natural olives fermented in brine that may be crushed and seasoned. Moreover, the production of these protected olives is negligible, less than 1% of the total Spanish production. It also happens in other European countries where the protected table olives represent a very low percentage of the national production. In fact, there are 28 Spanish PDOs of olive oil but these oils account for a very low percentage of the national and international market. In addition, more than half of the total European protected olives are processed as natural olives (Table 1) whereas consumers demand treated olives (Spanish-style gren olives) and

oxidized olives (California-style black olives). However, this situation will probably change in the near future as the new Spanish PGI "Aceituna Manzanilla y Gordal Sevillana" could protect around 30-40% of Spanish table olives. These are olives processed following the Spanish style that gives rise to a product that is highly appreciated around the world.

This work was supported by the Spanish Government Project AGL2016-76820-R (AEI/FEDER, UE).

There are no financial or commercial conflicts of interest.

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275 **Figure captions**

276 **Figure 1**. Geographical location of the Spanish PDOs and PGI of table olives.

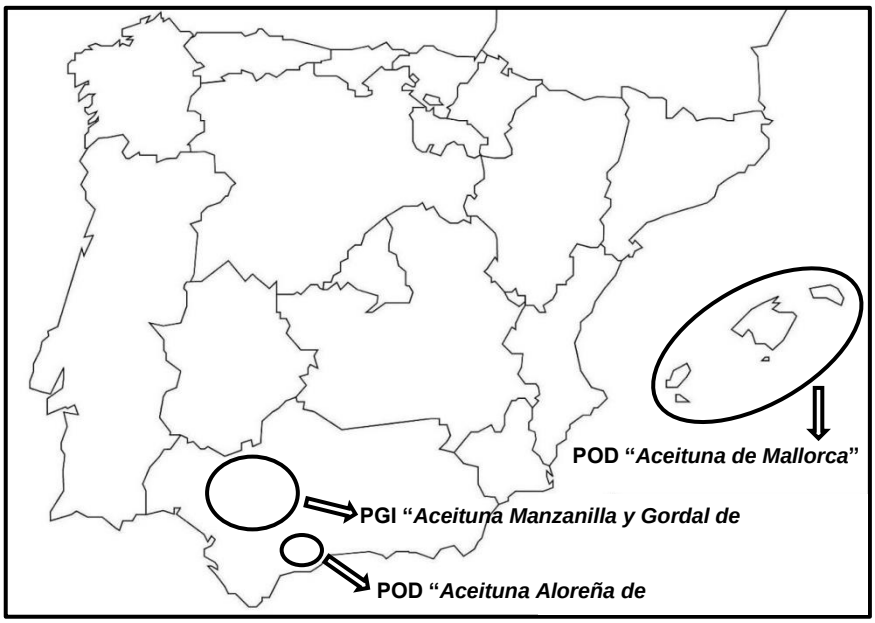
277 **Figure 2.** Logos of the two Spanish PDOs and one PGI of table olives.

278 **Figure 3.** Flow chart of the three elaboration processes of table olives from the PDO
279 "Aceitunas Aloreñas de Málaga".

280 **Figure 4.** Spanish production of Manzanilla and Gordal olive cultivars.

281 **Figure 5.** Flow chart of the method used for processing the PGI Manzanilla and Gordal
282 olives.

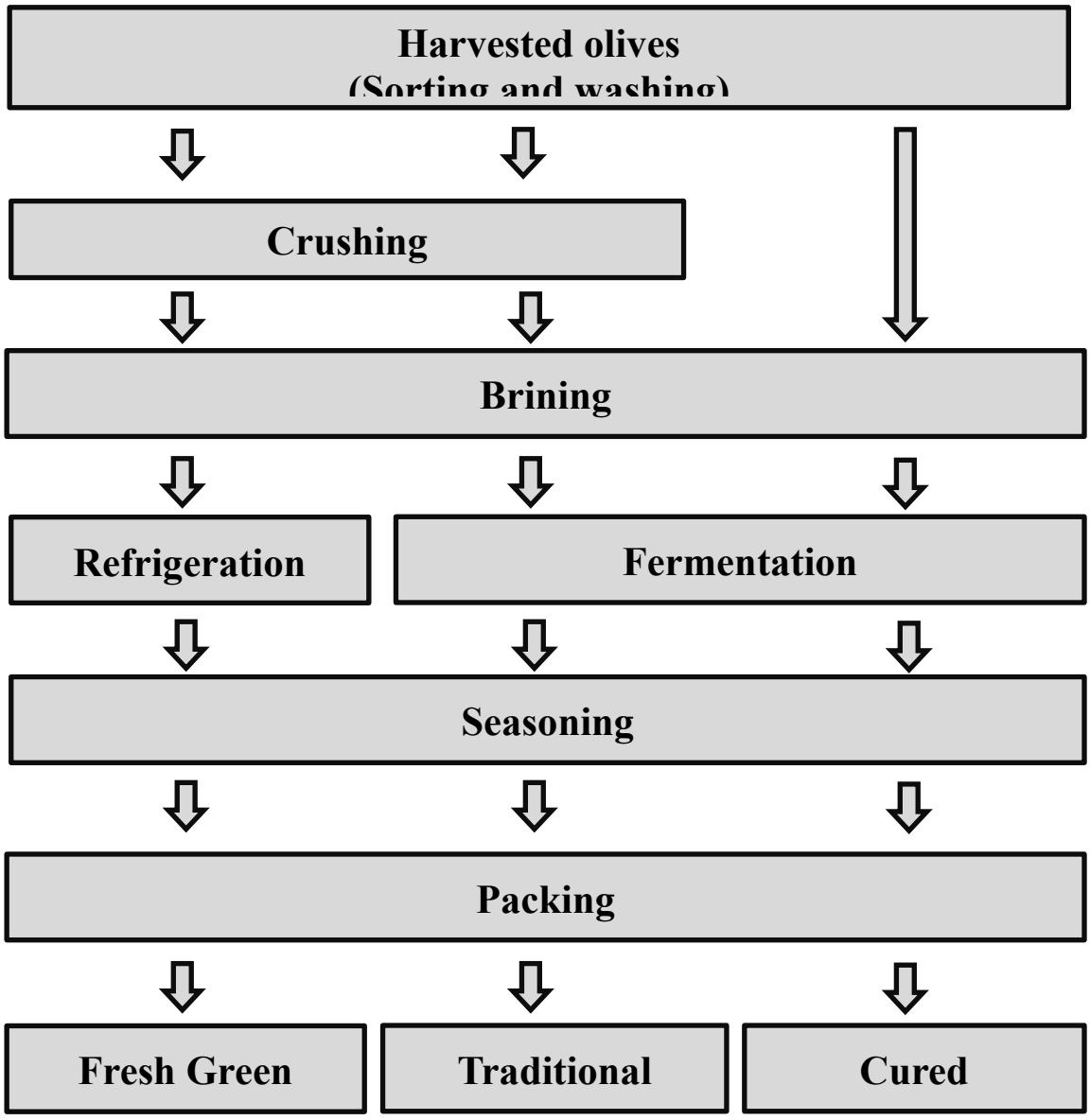
283

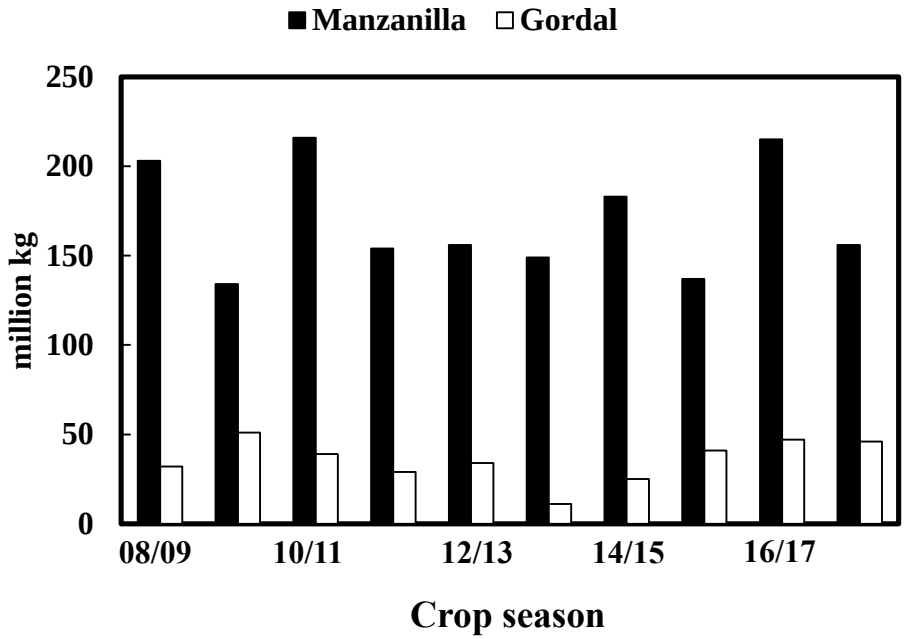

POD "*Aceituna de Mallorca*"
PGI "*Aceituna Manzanilla y Gordal de*
POD "*Aceituna Aloreña de*

PDO “Aceituna Aloreña de Málaga”

PDO “Aceituna de Mallorca”

PGI “Aceituna Manzanilla de Sevilla”


Harvested olives
(Sorting and washing)
Crushing
Brining
Refrigeration
Fermentation
Seasoning
Packing
Fresh Green
Traditional
Cured


Manzanilla
Gordal
250
200
150
100
50
0
million kg
08/09
10/11
12/13
14/15
16/17
Crop season

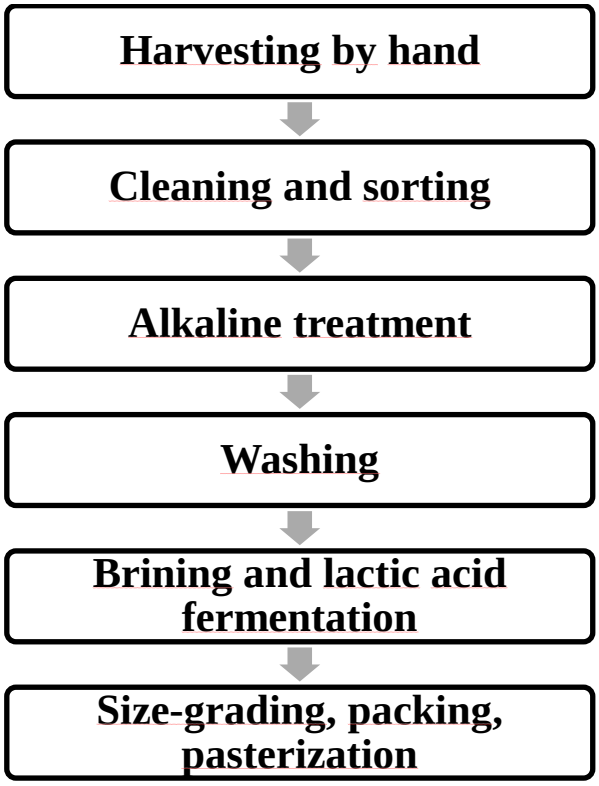

Harvesting by hand
Cleaning and sorting
Alkaline treatment
Washing
Brining and lactic acid fermentation
Size-grading, packing, pasterization

Table 1. PDO and PGI of table olives in European countries.

Country	PGI/PDO	Registered name	Date	Trade preparation
Italy	PDO	Nocellara del Belice	1998	Treated and natural olives
Italy	PDO	Bella della Daunia	2000	Treated and oxidized olives
Italy	PDO	Ascolana del Piceno	2005	Treated and natural olives
Italy	PDO	Oliva di Gaeta	2016	Natural olives
Portugal	PDO	Azeitona de Conserva Negrinha de Freixo	1996	Treated, oxidized, and natural
Portugal	PDO	Azeitonas de Conserva de Elvas e Campo Maior	2007	Natural olives
France	PDO	Olives noires de Nyons	1996	Natural olives
France	PDO	Olives cassées de la Vallée des Baux de Provence	1999	Treated olives
France	PDO	Olives noires de la Vallée des Baux de Provence	1999	Natural olives
France	PDO	Olive de Nice	2005	Natural olives
France	PDO	Olive de Nice	2005	Natural olives
Greece	PGI	Konservolia Artas	1996	Treated and natural olives
Greece	PDO	Elia Kalamatas	1996	Natural olives
Greece	PDO	Konservolia Atalantis	1996	Treated and natural olives
Greece	PDO	Throumpa Thassou	1996	Natural olives
Greece	PDO	Konservolia Rovion	1996	Treated olives
Greece	PDO	Konservolia Anfissis	1996	Natural olives
Greece	PDO	Konservolia Stylidas	1996	Treated and natural olives
Greece	PDO	Throumpa Ampadias Rethymnis Kritis	1996	Natural olives
Greece	PDO	Throumpa Chiou	1996	Natural olives
Greece	PDO	Konservolia Piliou Volou	1997	Treated and natural olives
Greece	PDO	Prasines Elies Chalkidikis	2012	Treated olives
Spain	PDO	Aceituna Aloreña de Málaga	2012	Natural olives
Spain	PDO	Aceituna de Mallorca	2014	Natural olives
Spain	PGI	Aceituna Manzanilla y Gordal de Sevilla	2019?	Treated olives