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ON THE ORIGIN OF 'GUARA' ALMOND

Dicenta et al. (2015) have recently published in "Scientia Horticulturae" an article on the origin of the almond 'Guara'. The authors are making some considerations affecting more or less directly to my work during my dedication as a researcher and to the results I obtained. Therefore, I feel myself obliged to make some precisions to clarify some points before judging the results presented by the authors.

First I would like to remind that 'Guara' was put freely available for the growers in the years 1980s as a result of a clonal selection in the SIA of Zaragoza (now CITA of Aragón). It was introduced in our collection in 1970 under the name 'Cristomorto' from the collection established by Ramon Vidal-Barraquer in Tarragona and identified in our records as 121. This origin was clearly stated in the first description of 'Guara' (Felipe and Socias i Company, 1987) and in my book (Felipe, 2000):

'GUARA'

Origin: It comes from a clonal and sanitary selection carried out at the Unidad de Fruticultura of the Servicio de Investigación Agraria of Zaragoza from a variety introduced under an erroneous name.

At the same time 'Tuono' was introduced from the same collection of Ramon Vidal-Barraquer in Tarragona and was identified in our records as 124. 'Tuono' was also introduced later in several occasions from different origins, including that of the French INRA and the Orero nursery. However, after stating, with the tools then available, that all 'Tuono' introductions were probably the same, only the 124 genotype was maintained. Similarly, it was also concluded that clone 121 did not correspond to the description of 'Cristomorto' and to its identity when this cultivar was also introduced from other origins.

Genotypes 121 and 124 have been maintained in the National Almond Repository since then and our observations showed some differences

between them, such as in frost tolerance and percentage of double kernels, despite a high level of similarity for many morphological traits. Genotype 121 attracted our attention because of its constant productivity, kernel quality, early ripening and frost resistance, thus considering that it required a closer examination.

It was soon discovered that clone 121, as well as 'Tuono' and many other introductions, was affected by several viruses. R. Gella, in charge of the virus studies in our department, applied thermotherapy sanitation to clone 121, obtaining a clean clone, from which all future propagations were made. Consequently, we have always stated that 'Guara' came from a clonal and sanitary selection.

After verifying that the virus sanitation did not negatively affect the positive traits of clone 121, it was studied in our department, mainly in order to state its set ability both after self- and cross-pollinations, showing its autogamy. It was also tested in commercial orchards thanks to the offer of some growers. The agronomical behaviour was always satisfactory, since this clean clone 121 produced a crop in years when other cultivars lost their crop after heavy frosts, especially when compared with the traditional early-blooming Spanish cultivars.

This was clearly shown in an orchard at Peñaflor, near our Research Station. It was a non-irrigated orchard consisting of traditional Spanish cultivars and nearly unproductive. After topworking with 'Guara', this orchard became highly productive according to its conditions, maintaining this productivity since then.

All these results suggested that this clean clone had very interesting traits for the Spanish almond growing conditions, characterised by late spring frosts, pollination deficiencies, and other awkward conditions, despite it showed some negative traits, such as the presence of double kernels and sensitivity to some fungal diseases. These negative traits, however, did not really affect its good productivity and economical benefit for the growers.

Considering these advantages over the traditional Spanish cultivars, and not knowing the real name of clone 121 and its origin, we decided to give to this clone a name and as such it was included in the Spanish register of commercial cultivars. It was not protected but put at the free disposal of the Spanish almond sector. Probably as a consequence of being a free cultivar of outstanding performance it was re-grafted on old almond trees in a large amount, not included in the statistics of trees produced by the Spanish nurseries. As a consequence of being a free variety, neither the Institutes nor the authors involved in its release have ever obtained an economical benefit as a royalty coming from its propagation.

We have never hidden the origin of 'Guara', having received a new name because it came through the selection of a previous genotype of unknown name. All the selection process was included in different research projects funded by INIA and SIA, Institutes receiving the pertinent research reports according to the evolution of the work. It is convenient to recall that 'Guara' is highly appreciated by the growers due to its autogamy, productivity, frost resistance and early ripening. Due to this outstanding performance, it has inspired the other almond breeding programmes in Spain. Probably the success of 'Guara' induced the incorporation of self-compatibility as an objective by other breeding programmes, which undoubtedly are trying to improve it.

In any case, if 'Guara' was identical to 'Tuono', is it a real problem? It would be a selected clone of 'Tuono' and this would not affect its quality neither its ability to satisfy the need of the growers. In fact, several morphologically different genotypes have been called 'Tuono' according to the description of different almond repositories. Does it affect the results of growing 'Guara'? Some more questions could be put in relation to its origin:

The fact that 'Guara' could be a select clone of 'Tuono' would reduce the benefits obtained by the growers without causing any harm to anybody?

Does it represent a fraud in the task of a researcher trying to solve the problems of the Spanish almond growing, as clearly shown by the results obtained in growing it? In doing that did we commit an outrage?

The merit that 'Guara' has solved, at least partially, the serious problems of almond production in our Mediterranean conditions may be denied?

In any case, 'Guara' was a new clean clone of almond and as such deserved to receive a name and be propagated as such to maintain its identity. Therefore, it seems incomprehensible that whereas the Spanish almond sector recognizes the success of this cultivar because we tried to solve the problems of this sector, some other researchers are trying to discredit that work arising doubts about its identity and origin.

As a consequence, the insinuation that 'Guara' is the result of a fraudulent process shows a real ignorance about the origin of this cultivar and tries to instill doubts on our sane intention and moral duty to provide the growers a more efficient plant material than that previously grown, reaching with it a full revolution in the Spanish growing sector.

Dicenta et al. (2015) did not pay sufficient attention to the origin of 'Guara' and did their work without a proper methodology. They utilized materials from their collections without going to the original materials in the CITA repository in order to ensure their identity, precisely in a type of work looking to establish the identity of a plant material. Many nursery plants have been probably sold under the name of 'Guara', due to its success, but could be 'Tuono' or other similar cultivars. Only the CITA plants could ensure the trueness to type of the materials. Only working with the CITA material would give credibility to the results of such type of identification. As this has not been the case, we may suspect that the interest of this work has been another.

The authors could question better their work instead of that of Fernández i Martí et al. (2009), carried out with the CITA materials, where small differences between 'Guara' and 'Tuono' were detected in their molecular profile. Small differences in morphology and behaviour were also noticed in our collection, as well as by nurserymen, growers and processors. Additionally, the authors had to know that identity in molecular markers does not

mean identity of genotypes, but only great similarity, and that the establishment of identity between two genotypes requires much more than a simple molecular profile. Probably they did not include the right markers, or their vision was previously defined and only limited to molecular markers instead of looking to the whole tree.

Finally I ask myself if the efforts of 11 researchers, with additional external support, were required for this article, considering its deficiencies, its very low scientific interest, and its questionable objective. Would it have been published in "Scientia Horticulturae" if one of the authors was not an editor of the journal? The scarce research funds could be better directed to more profitable objectives.

Was their only objective to discredit my work, honestly focused in offering a better plant material to the almond sector and whose success in being accepted by the growers has not had any similar success in the Spanish almond sector?

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THE ALMOND IN ARGENTINA: EVOLUTION OF CROPS AND VARIETIES IN PATAGONIA

DEVELOPMENT OF THE ARGENTINIAN ALMOND SECTOR

A large part of Argentina's population comes from the waves of immigration that took place from the XIX century to the beginning of the XX century, mainly from Spain and Italy. The custom of eating nuts, especially almonds, was introduced by the Spanish and Italian immigrants and others. Even though they are consumed all year round, the peak season for demand is from October to December, when industry requires almonds for Christmas bakery products.

As for soils and climatology, Argentina has large areas with very good almond-growing conditions: appropriate soils, high summer temperatures, low relative humidity, sufficient water for irrigation, lack of pests and limiting diseases, thus enhancing the possibilities of growing this crop over large areas. Most almonds are grown today in the provinces of Mendoza, San Juan and La Rioja, and to a lesser extent in Catamarca, San Luis, Salta, Buenos Aires, Río Negro and Neuquén (see Fig. 1). The estimations of the planted surface area up to 2016 are shown in Table 1, most of which are young orchards (almost 50%) which have not yet reached full bearing.

Table 1. Estimated almond-growing surface area in Argentina

PROVINCE	surface area (ha)
Mendoza	2,950
San Juan	680
La Rioja	510
Río Negro-Neuquén	220
Salta	200
Other provinces	270
Total country	4,830

Source: own data based on provincial censuses and information from the nursery sector.

The Argentinian production sector is characterized by small or medium-sized individual producers or small farms with surface areas under 10 ha (approximately 80%). The remainder is composed of large businesses with estates growing over 100 ha of crops.

Orchard technology has evolved in recent decades through different forms of pressurized irrigation, higher planting densities and new plant material. Together with the irrigation system and intensification of modern water delivery systems, tree spacing has become more intensive, with inter-row distances decreasing from 7-8 metres to 6-5 metres, and distances between trees from 6-7 metres to 5-4 metres. The densities have thus evolved from 230-250 to 400-500 plants/ha in almost 80% of almond orchards today.

THE EVOLUTION OF ALMOND VARIETIES

The almond was introduced in Argentina by the first Spanish settlers in the XVI and XVII centuries, mainly the Franciscan and Jesuit missionaries arriving from the North and West of the country. The first orchards were planted in the current provinces of Salta, Catamarca, La Rioja, Mendoza and San Juan in small family orchards with almond seedlings that provided wide variability, but because of their early flowering date the orchards suffered losses in harvest from late frosts. From the XIX century until the beginning of the XX century, the varieties introduced by the immigrants were used as grafting material, thus initiating the first commercial plantations. In the first years of development of the important market crops in Argentina, low-quality and self-incompatible varieties were predominant. Lack of knowledge of how to pollinate the species correctly led to errors in the combination of varieties and incompatible crops were included or pure blocks of a single self-incompatible variety were planted, leading to frequent failures.

The seedlings and local selections prevailed in the first years and production was successful, particularly Martinelli C, Martinelli L, Desmayo Catamarca, Cáceres Clara Chica and Cáceres Roja Grande. In the 1950s Californian varieties were introduced for the first time, namely Non Pareil, Nec Plus Ultra, IXL and Texas, followed by varieties obtained on a national scale by the INTA, such as Emilito and Javier. This led to a substantial improvement in the quality and quantity of production, whereby they were able to supply the national market. However, this supply was irregular as in many years, losses caused by climate phenomena such as spring frosts reached almost 100%.