Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 19, Issue 1, 2019
PRINT ISSN 2284-7995, E-ISSN 2285-3952

SYRAH - GRAPEVINE AND WINE- A CRITICAL REVIEW

Luminita VISAN[1], Radiana-Maria TAMBA-BEREHOIU[1], Ciprian Nicolae POPA[2], Silvana Mihaela DANAILA-GUIDEA[1], Ricuta Vasilica DOBRINOIU[1]

[1]University of Agriculture and Veterinary Medicine Bucharest, Faculty of Biotechnologies, 59Mărăşti Bvd, District 1, zip code 011464, Bucharest, Romania, tel. +40721135314, E-mails: l_visan@yahoo.com, radianatamba@yahoo.com; silvana.danaila@yahoo.com;
[2]Farinsan SA, Gradistea village, Giurgiu district, Romania, E-mail: cipnpopa@yahoo.com

Corresponding author: l_visan@yahoo.com

Abstract

The Syrah grape vine variety was introduced to us in the country relatively recently, after 2000, although in other wine-producing countries in Europe and even on other continents the wine obtained from it is highly appreciated. Syrah wines have strong character and personality, are tanned and strongly colored, with high alcohol content. Wines have floral (violet) or fruity flavour (raspberry, blueberries, blackberries, and dried plums etc.). Most Syrah wines have a great maturation and aging capacity, due to the compositional characteristics (mainly tannin richness), maturing, resulting in a complex aroma, spicy characteristic of black, red or green pepper, spices, olives, anise, etc. On our lands, studies about variety and Syrah wine are few and low significant, although in recent years there is already talk in the oenological field about very valuable Syrah Romanian wines assortment.

Key words*: Syrah, Shiraz, Côtes du Rhône, Cornas appellation*

INTRODUCTION

The *Syrah* or *Shiraz* variety, as it is called in the "New World" of viticulture (Australia, South Africa, Argentina etc.), is a grape vine variety of *Vitis vinifera* L., intended to produce high-quality red wines.

Although grown in France, Australia and other countries since the pre-philoxic period is appreciated at its true value only in the last decades, the wines obtained are considered among the best wines in the world [25].

As far as the origin of the variety is concerned, it has long been believed to originate in Iran, in the same name (Shiraz city), in Cyprus or in Syracuse (Sicily), from where it was brought to France by the 13th century by the knight Gaspard de Stérimberg and grown in the Hermitage area (Vallée du Rhône). According to other authors, the *Syrah* was brought back from the 3rd century and cultivated in this area of France [20].

Based on DNA studies, it has recently been proven that the variety originates in south-eastern France as a result of hybridization between *Dureza noir* and *Mondeuse Blanche*. These studies, initiated in 1998 at I.N.R.A. Montpellier and the University of California, Davis, confirmed the theory of the French ampelographers J. André and L. Levadoux, who since 1964 introduced the *Syrah* into the group of serins, along with the varieties: *Mondeuse noire, Mondeuse blanche, Marsanne, Roussane, Viognier, Dureza* etc. [7], [24]. Serins represent a group of vine varieties belonging to the *Vitis vinifera* species with common morphological characteristics and ultimately of common genetic origin [31].

Today, the most famous *Syrah* wines (Hermitage, Crozes-Hermitage, Côte Rôtie, St. Joseph) are obtained in France, also in the same area, in the northern part of the Côtes du Rhône.

Syrah or *Shiraz* wine produced today in countries like France, Australia, South Africa, Spain, etc. already has a reputation, being considered a wine with a special aromatic and chromatic complexity. This is different from the wine of this sort produced a few decades ago, more so than wine produced in different countries under the name of *Shiraz* wine [32].

Lately, *Shiraz* producers dropped the high yields of grapes, by applying different wine practices and methods. At the same time, they practiced a modern wine-making and special methods aimed at highlighting the full potential of the variety and obtaining known today wines for the undeniable quality [23].

MATERIALS AND METHODS

A series of databases on the origin, morphological, physiological and agrobiological characterization of the *Syrah* variety, the vineyards areas occupied with the *Syrah* grape vines, the wines obtained, and the main producing countries were studied.

RESULTS AND DISCUSSIONS

Description of the *Syrah* variety. The leaves are medium in size, orbicular, 5-lobate, with edges with short and ogival teeth and the petiolary sinus in the form of lire or "U" is marked at the petiole point (Fig. 1). The young strings covered with a fine white fluff, they are fragile and can be easily broken; that's why they are bound at espalier, spring in March [19].
The grapes are of medium size, cylindrical or cylindrical-conical shape, quite compact, sometimes winged; in autumn the peduncle is rapidly wooding, and the leaves get a rusty colour on the edges of the leaf.
The berries are small, oval, blue-black colour, with smooth but strong skin, covered with abundant pruin (Fig.1). The mesocarp is juicy, with pleasant taste, without flavour [15].

Fig. 1 Shape of leaf and grape in *Syrah* variety
Source: en.wikipedia.org.

The period of vegetation of the variety is long, 190-200 days, the maturing is late (in the V-VI age, September 20-October 15, depending on the vineyard placement).
The variety has a medium to high force, poor fertility (about 65% fertile) and low yield. The production is 10-12 tons/ha, but it can grow under the conditions of fertilization (with P, K, foliar fertilizers, etc.). Also, the yield of the variety may increase when applying a long or mixed cut (Guyot, single or double type); in the Mediterranean regions to obtain a good yield but also a quality wine is enough to practice a short cut [8].
Syrah's variety adaptability is quite high, although it prefers the continental climate with sunny and moderately hot summers with cooler nights, low humidity, climatic features found for example in France, in the Vallée du Rhône and even in Bordeaux, but up to the Toulouse [2].
This climate leads to the making of *Syrah* premium, strong, elegant and delicate flavors wine. A climate with too high temperatures makes the wine appear dark blackberry, jammy and fruit plum characters. In fact, the *Syrah* is a drought-sensitive variety but also has low frost tolerance.
As for the soil, *Syrah* is a variety with a high sensitivity to ferrous chlorosis, which leads to the obligation to avoid heavy soils with insufficient ventilation, with excessive calcium. He prefers stony, well-drained soil with a higher iron content, with a more acidic pH. The organoleptic characteristics of the *Syrah* wine vary depending on the soil of the plantation: the stony, acidic lands lead to more robust wines, personalized yet elegant and delicately flavoured wines; and the sandy ones to fine wines with discreet aroma. The shale structure of soil, although favourable to the variety, still lead to the production of wines with a high pH, generally *Syrah* being characterized by a low acidity [29].
The variety is quite vulnerable to disease attack (downy mildew, gray rot) and pests (*Eriophyes vitis*, red spider).
The wine is strongly colored (dark violet red), with a high content of phenolic compounds, tannin even astringent, with spicy flavor, fruit, etc. Recent studies have highlighted the fact that among the red wines, *Syrah* has the highest content in resveratrol, which is very

important for food hygiene and consumer health [4], [11].

Its high tannin content makes it particularly suited for maturing and aging, the wine achieving outstanding organoleptic qualities after 10-15 years [5]. So, if *Syrah* wine is highly tannic even astringent in the youth, sometimes with a bitter temptation, after maturation it becomes an elegant and fine wine with spicy flavors, pepper, mint, herbs, dried fruit, olives, anise etc. [26]. Some *Syrah*'s wines show "heavy" spices aroma, dried truffles and prunes, along with great chocolate shades [29].

The surface cultivated with the *Syrah* variety is constantly expanding, both in France and in other European countries or in the "New World". If in France, at the level of 1958, the cultivated vineyard area was about 1,000 ha, it evolved continuously, at 12,300 ha in 1980, to the 37,000 ha in 1997 and today being the country with the highest production of *Syrah* wine, reaching a surface cultivated over 64, 000 ha.

On worldwide level, cultivated area in the 31 producing countries of *Syrah* grapevine is 190,000 ha (the area registered in 2016) being distributed as follows: France 64,000 ha (7.9% of the country's vineyard area); Australia 40,000 ha (26.8% of the country's vineyard area); Spain 20,000 ha (2.1% of the country's vineyard area); Argentine 13,000 ha (5.8% of the country's vineyard area); South Africa 11,000 ha (10% of the country's vineyard area); USA (California) 9,000 ha (2% of the country's vineyard area); Chile 8,000 ha (3.8% of the country's vineyard area); Portugal 6,000 ha (3% of the country's vineyard area); China 1,000 ha (0.1% of the country's vineyard area) [21]. *Syrah* wine is also produced in Mexico, Swizerland, New Zealand etc. (Fig. 2).

In Romania, from 180,200 ha of area under vineyard cultivation 170,292 ha are occupied with varieties intended for wine production [30].

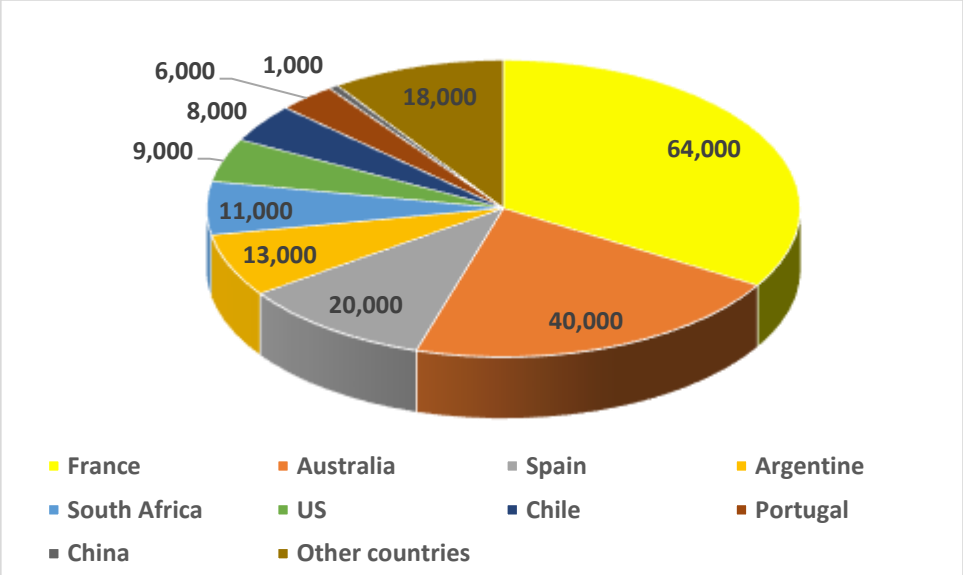

Fig. 2. The main Syrah grapevine variety producing countries (ha cultivated area)
Source: Organisation Internationale de la Vigne et du Vin, 2017

Out of this area about 16% (27,135 ha) is the area planted with vines intended to produce red wines, the remaining 84% being represented by grapevines for white wines (143,157 ha). Table 1 shows the total area planted with vines at the level of 2017, which is distributed in the main wine regions of Romania [30].

In Romania, the *Syrah* variety is grown on small surfaces, although there is a concern among wine producers to increase these areas. *Syrah* grapevine is grown currently only in some geographic regions, such as: Oltenia

(South-west area), Muntenia (South area), Dobrogea (the southeast area), Crișana (northwest area) and Maramureș (North area), [9]. The most famous wine cellars that produce *Syrah* wines are, according to the Gault & Millau Guide (2018), are [13]:

-In Oltenia region: *7Arts Wine cellar* (in Breasta and Banu Mărăcine village), this wine cellar focused on the production of premium wines; *Oprișor Wine cellar* (Golul Drancei village, Mehedinți county). The Oprișor Wine cellar was the first *Syrah* Romanian wine producer.

-In Muntenia region: *Budureasca Wine Cellar* (Gura Vadului village, Dealu Mare vineyard); *Metamorfosis Wine Cellar* (Ungureni village, Dealu Mare vineyard); *1000 Faces Wine Cellar* (Urlați city, Dealu Mare vineyard); *Lacerta Wine Cellar* (Fintești town, Dealu Mare vineyard).

Table 1.The Romanian vineyard area, spread over the main Wine Regions

Wine Regions	Vineyard area (hectares)
Dealurile Moldovei (Moldova Hills)	65,200.3
Dealurile Olteniei si Munteniei (Oltenia& Muntenia Hills)	51,942
Colinele Dobrogei (Dobrogea hillock)	16,330.9
Sands and other favorable land in the south of the country	12,596
Terasele Dunării (Danube Terraces)	10,778.1
Dealurile Crișanei si Maramureșului (Crișana & Maramureș Hills)	9,588.8
Podișul Transilvaniei (Transilvania Plateau)	6.695.8
Dealurile Banatului (Banat Hills)	4,016

Source: http://www.madr.ro

-In Dobrogea region: *Bogdan Domain Wine Cellar* (Peștera vilage, Murfatlar vineyard); this winery practice biodynamic viticulture, including the variety *Syrah*.

-In Crișana region: *Maximarc Wine Cellar* (Masca vilage, Miniș vineyard);

-In Maramureș region: *Nachbil Wine Cellar* (Beltiug vilage, Sătmarului Hill vineyard), where the vineyards in this area enjoy a cool and abundance climate in precipitation. Winters are gentle and sheltered by cold winds and blizzards. Also, in September the temperature drops sharply by minus 3-4°C, which leads to the preservation of the aromas and acids of the grapes; *Hetei Family Wine Cellar* (Beltiug vilage, Silvaniei vineyard).

The main *Syrah*'s wine producing countries:

France is the world's largest producer of Syrah wines, the country with the largest area cultivated with this variety (64,000 ha). The largest areas are located in the northern part of Rhône, between the towns of Lyon, north (rather Vienne) and Valence and Dauphiné in the south, the Hermitage area being the most famous (Crozes-Hermitage, Tain-l'Hermitage) In this area *Syrah* variety finds the ideal conditions for giving premium wines with an original home name: hot summers, but not drought, low humidity, hot days alternating with cold nights, high brightness, protection against the northern winds, acidic, stony soils. The average annual minimum temperature is about 6.5°C and the maximum average temperature is about 16°C (the highest temperatures are recorded in July and August (average temperature 26°C).

The quality levels of the Côtes du Rhône wines are:

-The Côtes du Rhône AOC (or AOP), represents about 50% of the total wine production obtained in the Vallée du Rhône, the largest share being the *Syrah* and *Grenache* coupage;

-Côtes du Rhône Villages AOC, which includes structured, complex wines, suitable for maturation and aging;

-Côtes du Rhône nommé AOC Villages (21 AOC locality);

-the Crus: in the Rhône Valley there are 17 locality called AOC, the wines produced here representing about 20% of the wine production of the Rhône Valley. In Cornas village is produced only red wine of the Syrah variety [28].

The local names of northern Côtes du Rhône: Cornas (100% *Syrah* wine), Côte-Rôtie (minimum 80% *Syrah* wine), Hermitage (minim 85% *Syrah* wine), Saint-Joseph (minim 90% *Syrah* wine).

Syrah is authorized to produce red wines of the Cornas appellation as a unique variety; for

the Hermitage, Crozes-Hermitage and St. Joseph appellations *Syrah* is blended with Marsanne and Rousanne wines (10 and 15% of the coupage respectively); for Côte Rôtie apellation *Syrah* is coupled with *Viognier* wine (20% of the coupage).

The most famous *Syrah* wines (Hermitage, Cornas, Côte Rôtie, Saint-Joseph) obtained in this area, are well-structured wines, strong but especially elegant, intensely colored (dark red) and with the complex aroma, imprinted by the special terroir [17]. The characteristic aromas are floral (violet) and spiced, of pepper. After maturation, the flavors evolve to shades of truffles, ripe fruit and amber.

The famous Hermitage wine is grown in the vineyard of Tail-l'Hermitage, Crozes-Hermitage and Larnage locality, in the Mediterranean climate, with slopes, southern exposure and limestone and granite soils [27].

In other parts of France (Bordeaux, Bourgogne-Beaujolais, Languedoc-Roussillon, Provence, Corse, Rhône-Alpes), successful coupage wines are produced between *Syrah* with *Cabernet Sauvignon, Merlot, Grenache noir, Carignan*, etc. Also, rosé wines with fruity, fresh aroma are obtained [14].

In **Australia**, the world's second-largest producer of *Shiraz* wines after France, wines are obtained in almost all the wine regions of this country, intensely colored, tanned wines with strong personality and distinctive flavors. *Shiraz* has been grown here since the 19th century (1830), although the growth of vineyards for red wines, especially between 1980 and 1990 [1]. Today, *Shiraz* is the most famous variety with the largest share in Australia, with the cultivated area being over 40,000 ha. Australia is also a renowned exporter of *Shiraz* wines, of great quality [3].

Representative viticulturally regions for *Shiraz* variety cultivation and wine production are Barossa Valley (Shiraz's oldest and best-known region for Shiraz culture), McLaren Vale, Clare Valley, Eden Valley, Hunter Valley, Heathcote, Canberra. Here, besides *Shiraz* wines and famous blends, with a long tradition where it is combined, in varying proportions with *Grenache* and *Mourvedre* wines, or with *Cabernet Sauvignon* wine [16].

Wine Penfolds Grange is Australia's most famous *Shiraz,* being the most award-winning and appreciated for export, wine which, according to some authors, managed to bring out Australian wine from anonymity [28].

The wine also contains a small percentage of *Cabernet Sauvignon*, and lately 4% of *Viognier* white wine, to add a fresher shade of coupage, apricots, acacia and citrus flowers. The addition of *Viognier* wine to *Syrah* wine is a practice taken from France, the Côte-Rôtie area [27].

The reason for the practice, it seems, is not only the complexity of the flavor but also the color of the wine. As we know, anthocyanins are phenolic compounds that give the color of young red wine, but these substances are unstable over time, reacting with oxygen, sulfur dioxide, etc. and thus losing its importance for the color of evolving wine [10]. In the mature wine color, other compounds, such as polymers pigments that are born during alcoholic fermentation following the reaction between anthocyanins and tannins, the link being stronger and providing a stable color over time [6].

There are also pigments, resulting from the combination of anthocyanins with other phenols, as well as aldehydes or other compounds [22]. A special group, important for the stable color of mature wines, is represented by the co-pigmented anthocyanins, which are molecular associations resulting from the combination of anthocyanins with uncoloured organic components [12]. These co-pigments ensure the intensity and stability of the mature wine color, which explains the addition of *Viognier* wine, rich in copigment, to the *Shiraz* wine [18], [25].

South Africa is famous, especially for *Cabernet Sauvignon* and *Chenin Blanc* wines.

Of the total surface area of 94,545 ha, the *Cabernet Sauvignon* variety represents about 11% of the area occupied by the wine-producing varieties, and the *Chenin* variety 18.6% of this area. The *Shiraz* variety occupies 10.3% (11,000 ha) of the area under vines for South Africa, the third variety as the cultivated area.

The vineyards of the country are grouped in 5 wine regions and 20 districts. Most South African wines are produced in the Western Cape Province of South Africa. The most important vineyards are: the vineyard of Stellenbosch, the vineyard of Paarl, the vineyard of Constantia, the vineyard of Swartland, with Malmesbury and Darling (in Cape South Coast); the vineyard of Robertson, vineyard of Worcester (Breed Valley), vineyard of Douglas, etc.

The *Shiraz* variety is mainly grown in Stellenbosch and Paarl, cold areas, the *Shiraz* wines obtained here are savoury, fruity flavors.

Shiraz wine is also produced in the Swartland and Robertson regions, areas with a drier climate that lead to richer, stronger, more complex wines [33].

South African *Shiraz* becomes famous only in 2007 when the producers of this wine quit high yields and focus on quality. It is thus exported to the "Old World" of wine, but also to USA, premium *Shiraz* wines with exotic flavors, spices and black chocolate shades, making this *Shiraz* characteristic of South Africa.

Spain.The Spanish vineyards are spread over 69 major wine regions with "Designation of Origin" (D.O). Of these, the most famous in the world of wine are: Rioja (in North-Central Spain, the most representative varieties are *Tempranillo*, *Maturana tinta*, *Grenache*); Penedés (in Catalonia, North-East Spain); Priorat (in Catalonia); Ribera del Duero (in the Burgos region, on the Duero river valley); Valencia; Navarra; La Mancha (in Central Spain); Rueda (in Castilla y Leon); Murcia and Castilla-La Mancha; Ribera del Guadiana (in Extremadura); Madrid [29].

The *Shiraz* variety is cultivated in several wine regions: Penedés, Priorat, in La Mancha, Murcia, Jumila, Madrid, Ribera del Guadiana etc. *Syrah* wines from La Mancha and Mediterranean regions (Murcia) are among the most popular.

The Spanish *Syrah* wine is different from the French or Australian, being more alcoholic and more robust. In the Priorat region *Shiraz* variety finds wonderful conditions of climate and microclimate, soil and exposure of plantations on sunny terraces.

In the Priorat region wine is obtained "Barranc dels Comellars Negre". This wine is appreciated and well received for export. Wine is actually a blend of *Shiraz* with *Garnatxa negra*, *Cabernet Sauvignon* and sometimes with *Grenache* and *Merlot*.

CONCLUSIONS

Syrah or *Shiraz* wines are famous all over the world, be it the old continent or the "New World" of wine. As they are known today, some of the world's finest wines, have been produced for only a few decades. The largest *Syrah* wine producers are France, Australia, Spain, Argentina and South Africa, only in these countries the surface cultivated with *Syrah* being nearly 150,000 ha.

Syrah wines are characterized by an intense color due to a high content of phenolic compounds, especially anthocyanins and tannins; are rich in tannins, savory and with a fruity or floral flavor. Due to the chemical composition, especially the polyphenols, they respond very well to maturing and aging.

The ripened wines for 10-15 years are unique in their complexity, with various flavors, from pepper, herbs, peppermint, to truffles, spices and black chocolate.

The Romanian Syrah was produced in the early 2000s and today it is a high-quality and perspective wine, although it is produced only by a few wine cellars, especially in southern Romania.

REFERENCES

[1]Anderson, K., Aryal, N., 2015, Growth and Cycles in Australia's Wine Industry: A Statistical Compend., 1843 to 2013, University of Adelaide Press: 20.

[2]Anivin de France, Vin de France & cepages, Encyclopédie dés Cepages de France, 2019.

[3]Australian Wine and Brandy Corporation: Areas of Vines and Grape production by variety, 2008.

[4]Beer, P., Strever, A., Du Toit., W.J., 2017, Do differences in the colour and phenolic composition of young shiraz wines reflect during ageing?, South African Journal of Enology and Viticulture, 38 (1):29-34.

[5]Bindon, K.A., Kassara, S, Cynkar, W.U., Robinson, E.M.C., Scrimgeour, N., Smith, P.A., 2014,

Comparison of extraction protocols to determine differences in wine-extractable tannin and anthocyanin in *Vitis vinifera* L., Shiraz and Cabernet Sauvignon grapes, J. Agric. Food Chem., 62: 4558-4570.
[6]Boulton, R., 2001, The Copigmentation of Anthocyanins and Its Role in the Color of Red Wine: A Critical Review, American Journal of Enology and Viticulture., 52(2): 67-87.
[7]Bowers, J.E., Siret, R., Meredith, C.P, This, P, Boursiquot, J.M., 2000, A Single Pair of Parents Proposed for a Group of Grapevine Varieties in Northeastern France, Acta Horticulturae, 528: 129-132, Proceeding of the Seventh International Symposium on Grapevine Genetics and Breeding.
[8]Clarke, O., Rand, M., 2001, Oz Clarke's Encyclopedia of Grapes, Ed. Hardcover:252-253.
[9]Crame, 2013, https://www.crameromania.ro/crame, Accessed on January 10, 2019.
[10]Downey, M., Harvey, J., Robinson J., 2003, Analysis of tannins in seeds and skins of Shiraz grapes throughout berry development, Aust. J. Grape Wine Res., 9: 15-27.
[11]Downey, M., Harvey, J., Robinson J., 2004, The effect of bunch shading on berry development and flavonoid accumulation in Shyraz grapes, Aust. J. Grape Wine Res., 10: 55-73.
[12]Fulcrand, H., Duenas, M., Salas, E., Cheynier, V., 2005, Phenolic reactions during winemaking and aging, Am. J. Enol. Vitic., 57: 289-297.
[13]Gault&Millau, 2019, Guide to Romanian Wines, Bucuresti.
[14]Gregutt, P., 2007, Washington Wines and Wineries: The Essential Guide, University of California Press.
[15]Günata, Z., Wirth, J., Guo, W., Baumes, R., 2001, C13-Norisoprenoid Aglycon Composition of Leaves and Grape Berries from Muscat of Alexandria and Shiraz Cultivars, Carotenoid-Derived Aroma Compounds, ACS Symposium Series, edited by Winterhalter P and Rouseff R.
[16]Halliday, J., 2004, Syrah in Australia Since 1800, The Syrah Producers'Club, Syrah Worldwide Roma: 10-14.
[17]Harbertson, J.F., Kennedy J.A., Adams D.O., 2002, Tannin in skins and seeds of Cabernet-Sauvignon, Syrah and Pinot noir berries during ripening, Am. J. Enol. Vitic., 53: 54-59.
[18]Kilmister, R.L, Mazza, M., Baker, N.K., Faulkner, P., Downey, M.O., 2014, A role for anthocyanin in determining wine tannin concentration in Shiraz, Food Chem., 152: 475-482.
[19]Larousse, 1997, Vins et Vignobles de France, Le Savour Club, Larousse-Bordas, Paris, France.
[20]Meredith, C.P., Boursicot, J.M., 2008, Origins and importance of Syrah N around the world, International Syrah Symposium, Lyon: 17–20.
[21]Organisation Internationale de la Vigne et du Vin, Focus OIV, 2017, Distribution variétale du vignoble.
dans le monde.
[22]Peng, Z., Iland, P.G., Oberholster, A., Sefton, M.A., Waters, E.J., 2002, Analysis of pigmented polymers in red wine by reverse phase HPLC, Aust. J. Grape Wine R., 8:70-75.
[23]Ribéreau-Gayon, P., Pontallier, P., Glories, Y., 1983, Some interpretations of colour changes in young red wine during their conservation, J. Sci. Food Agric., 34:505-516.
[24]Robinson, J., 2005, Viognier – it's everywhere nowadays, www.jancisrobinson.com, Accessed on Januarie 10, 2019.
[25]Roggero, J., Coen, S., Raponet, B., 1986, High performance liquid chromatography survey on changes in pigment content in ripening grapes of Syrah. An approach to anthocyanin metabolism, Am. J. Enol. Vitic., 37: 77-83.
[26]Shiraz, 2004, http://catalinpaduraru.ro/2004/06/shiraz/, Accessed on January 10, 2019.
[27]Tannins, 2018, http://www.wineanorak.com/tannins.htm, Accessed on February 2, 2019.
[28]The Guide to Côtes-du-Rhône Wine, 2013, https://winefolly.com/review/cotes-du-rhone-wine, Accessed on January 10, 2019.
[29]The Oxford Companion to Wine, Third Edition, Oxford University Press, Ed. Robinson J. and Harding J.: 676.
[30]Viticultura/Vinificatie, 2017, http://www.madr.ro/horticultura/viticultura-vinificatie, Accessed on January 10, 2019.
[31]Vouillamoz, J.F., Grando, M.S., 2006, Genealogy of wine grape cultivars: Pinot is related to Syrah, Heredity, 97: 102-110 .
[32]Wine & Spirits Education Trust, 2012, Wine and Spirits: Understanding Wine Quality, Second Revised Edition, London: 6-9.
[33]Wine of South Africa, 2017, Statistics on South African wine-grape vineyards over the past decade (2007–2017), www.wosa.co.za, Accessed on January 10, 2019.