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INFLUENCE OF TEMPERATURE AND HUMIDITY IN BLOOMING PHENOPHASE CONCERNING ON FRUIT SET IN SOME TABLE GRAPES *(VITIS VINIFERA* L.)

Marinela Vicuţa STROE, Toniţa Valentina DUNUŢĂ, Daniel Nicolae COJANU

University of Agronomic Sciences and Veterinary Medicine of Bucharest,
Department of Bioengineering of Horticulture-Viticulture Systems,
59 Marasti Blvd., District 1, 011464, Bucharest, Romania,
Phone: +40 21 318 36 36/216

Corresponding author email: marinelastroe@yahoo.com

Abstract

The aim of this study was to determine the influence of temperature and humidity on blooming phenophase and also on the percentage of fruit set of three table grapes varieties such as Muscat Hamburg cv., Afuz Ali and Victoria cv. (Vitis vinifera L). *For assessing the optimal timing analysis it was used a grading system called BBCH which is a universal scale for describing monocots and dicots numbered from 00-97, a special focus was made on the principal growth stage blooming and includes stages 61 and 67 and growth stage of fruit development stages 71 and 77. Results shows that there was a direct correlation between the average values of two analyzed factors and percent of fruit set, and also the size of fruits. Average temperatures below + 20˚C during blooming and a relative humidity of 65% has determined a good percentage binding at Muscat Hamburg (63%), followed by Afuz Ali variety (80%) and Victoria variety (86%). Surprisingly, even though the last two variety have formed more berries during the process of fecundation, proportion of very small berries (2-4 mm) and small berries(6-7mm) was high situated between 51.07% and 55.24%.*

Key words*: blooming, grows, phenology, table grape, variety.*

INTRODUCTION

In the last decade, world production and consumption of fresh table grapes registered a noticeable increase Moreover, the consumer market, both globally and nationally, had a significantly increased every year, drawing attention to ensure competitive products in terms of sensory characteristics but also a high (OIV, 2013, Rolle et.al., 2015).

To achieve a competitive production, which means a good quality and high yield, a number of factors are related mainly environmental (Shinomiya et al., 2015) and climate change (Jones, 2005), and also genetic varieties and applied technology Among the environmental factors involved in plant development cycles, phenological temperature is considered to be a key factor that can profoundly alter the timing entire spectrum phenology for different plant species but also within the same species in different varieties (Parker et al., 2013). Phenology of varieties is changeable not only in terms of temperature impact but also by a complex interaction between temperature, humidity, precipitation, hour of insolation, registered at the beginning of each phenophases (Chuine et. Al., 2003, Cleland et al., 2007). From the factors mentioned above, blooming phenophases and fruit set are the most influenced. Blooming phenophase - after Baggiolini is stage I, and stage 65 after scoring system BBCH, (www.diprove.unimi.it/GRAPENET/index.php) or stage 23 after scoring system made by Eichorn and H. Lorenz, (1977), (Pierot and Rochard, 2013), starts about 55- 65 days after bud stage, when flowers and inflorescences are fully developed (Stroe, 2014). Blooming period can last, depending on variety and climatic conditions, between 7-16 days. In northern areas this phenophase can lasts 16 days and it starts when average temperature is approximate 17,5°C, in the south vineyards can lasts only 12 days, and in the centre of the country where the thermal regime is characterized by a warm temperate

climate (Savu and Stroe, 2005) phenological phase lasts 7-8 days. In practice, it was observed that in the first 2-3 days after onset of blooming there was a percent of 20-30% open flowers, in the coming 3-4 days, 60-70% bloom and only a small percentage of flower bloom at the end phenophase, but in the inflorescence, the first flowers whom are opening are the one in the middle of it, followed by those from the base and, in the end, the top inflorescence (Mustea, 2004). Fruit set is a process of pollination and fertilization, a phenomenon influenced by biological, physiological, climate and technological factors.

Among the biological factors the most important is type of flowers, morphologic and functional, and also ability of pollen germination. Depending on the unfavorable conditions and fecundation during blooming the percentage of fruit set will be different, and berries will have a different evolution: very small berries is the lack of fecundation of flowers, berries remain small as a grain of millet after reaching 2-4 mm in diameter they do not increase, acquires a yellow-green base and forms a isolator layer, and therefore it occurs shaking berries (Dobrei et. al., 2005).

Millerandage is a common thing among grape varieties that require foreign pollen, and in this case, the berries stop growing the size of a peppercorn because of the lack of hormonal substances. Later, they mature earlier, and also can accumulate higher amounts of sugars and bring a good influence in production of quality wine grape varieties, but for quality of grape table varieties is a disadvantage. Even so, varieties studied in this paper are adapted to temperate continental climate in Romania they have a different response reaction in terms of the percentage of fruit set (Table 1).

Basically, adverse climatic conditions which means low temperatures (below 20°C), high humidity 55-65%, heavy rainfall - manifested in this phenophase can trigger a massive shaking of flowers, resulting in the formation of rare berry cluster, which occurs most often the millerandage phenomenon.

Studies have shown that percentage of fruit set is an average of 36% to Rhine Riesling, Gewurztraminer from 35%, 66% at Italian Riesling, 37% to Chasselas and 65% to Oporto (Irimia, 2012).

This phenomenon must not be mistaken with pollination and fertilization disfunctions, due to the fact that, in the first case, it represents a sugar redistribution disorder, with different effects depending on the period when it is initiated (Bernaz, 2003).

Under this circumstances, May occur other physiological diseases caused by either lack or excess of nutrients during some phases of the anual vegetative cycle.

Based on this consideration, the paper aim was to analyzed the influence and effect of temperature and humidity on fruit set development in the climatic conditions of the year 2016.

Results of this experience were analyzed under the quality parametres of a high yield/commodity production.

MATERIALS AND METHODS

Studied varieties and growth conditions

In this study were analyzed three varieties of table grapes: Muscat Hamburg cv., Afuz Ali cv., from the world's assortment and Victoria cv., a romanian variety obtained in 1978 by Victoria Lepădatu and Gh. Condei. The main data about these varieties can be found in Vitis International Variety Catalogue (www.vivc.de) and The European Vitis Database. In vineyard, all these three varieties have proven over the years, requiring a specific temperature and humidity during blooming phenophase. Table grape varieties are located in the experimental field of the ampelographic collection from the University of Agronomic Sciences and Veterinary Medicine of Bucharest. They have been conducted on the semi-stalk; the type of pruning in the prior year was Guyot on semi-stem, with a load of 30 buds/vine. During experiment observations and measurements were currently made for determining the elements of fertility and productivity, with a special focus was made on carpometry indices that define the productive potential: % fertile shoots, absolute fertility coefficient, relative fertility coefficient, absolute productivity index (g/shoot), relative productivity index (g/shoot), number of grape/vine, average weight of a grape (g), yield (kg/vine).

Short presentation of Muscat Hamburg variety.

Is a variety with medium vigor growth holding up relatively well at lower temperature during

winter and has a good fertility manifested by 70% fertile shoots. In normal years, the flowers have the capacity to fruit set up to 50% because the capacity of pollen germination is small, and that is why indicated to cultivate in vineyard with alongside varieties like Chasselas doré and Afuz Ali (Stroe, 2012).

Short presentation of Afuz Ali variety

Hardy variety, but sensitive to low winter temperatures (-16 °C, - 18 °C) with a long growing season 180-210 days, that is why fails to mature wood well. It has a great sensitivity to frost and this leads to poor resistance to diseases like bacterial cancer cancer and anthracnose.

Short presentation of Victoria variety

Variety with a medium to high vigor and has a good fertility, manifested by a percentage of 63-73% fertile shoots. Variety is characterized by good resistance to frost (-20 °C) and drought, it behaves well towards spring frosts because of late budbreak. It has an average resistance to mildew and very poor resistance to powdery mildew (Stroe and Veliu, 2010).

Phenological and temperature data

In this study it was used a update version of BBCH, an universal scale used for describing monocots and dicots numbered from 00-97, with special focus on the principal growth stage 6: Flowering, stages 61 to 67 and principal growth stage 7: Development of fruits, 71 to 77 (Pierot and Rochard, 2013). Three observations were made on all inflorescence of 6 vine for each variety separately in different stages of development as shown in table 2.

Meteorological parameters were analyzed in the period 20 May-20 June 2016 using daily averages of 6 points hourly results of the day (5:00, 08:00 11:00 14:00 17:00 20:00 23:00) it was recorded by weather station Bucharest - Baneasa, Romania. The calculation was conducted on a higher timeframe, to ensure better accuracy of results, even so phenophase of blooming at studied varieties lasted 12 days (20 - 31 May 2016).

RESULTS AND DISCUSSIONS

Although well adapted to the temperate continental climate from Romania, the varieties Muscat Hamburg cv., Afuz Ali and Victoria cv. responded differently in vineyard in what concerns the percent of fruit set, the pergentage of formed flowers shaken, and also the millerandage phenomen, which in particular years can put their marks on the obtained crops. Climatic particularities of the wine year 2016 resulted in earliness in flowering terms Cleland (2007), noticing that the varieties analysed bloomed in the third decade of May (Figure 1) within a period of 12 days (20 - 31 May 2016).

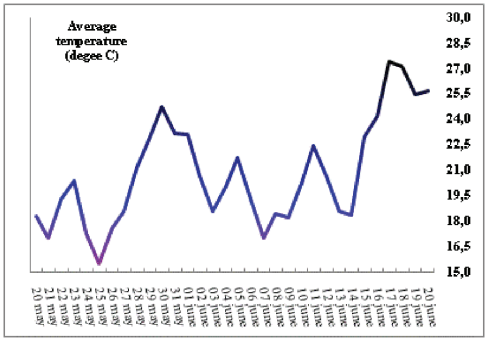


Figure 1. Evolution of the average temperature (°C) for period 20 May - 20 June 2016

In this amount of time, the average daily temperatures recorded presented in figure 1 were of 19.69°C with an inferior limit of 15.5°C recorded in 25th of May and a maximum of de 20.4°C in 23th May, bassically, when the blooming phenophase was at its best, beeing well known that in the first days from the flowering 20-30% of the total flowers, in the following days are flowering 60-70% and only a small percentage open at the end of the phenophase Mustea (2004).

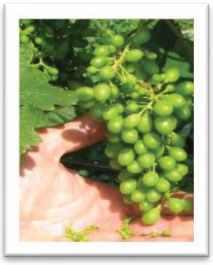
Regarding values of relative humidity (%) figure 2 gives an indication of their impact on analyzed varieties, because in the same period, the average was 70.65% with a peak of 83.12% in May 25th, values far exceeding the normal limit of blooming knowing that optimal conditions is in range 55-65%.

Following the recordings in figure 3, we notice that the percent of the fruit set is different from a variety to another, the Muscat Hamburg variety records the smallest percent (63%), followed by the Afuz ali variety (80%) and then Victoria variety (86%).

Table 1. The genetic origin of studied varieties

Prime name	**Muscat de Hamburg**	**Afuz Ali**	**Victoria**
Variety number *V*IVC	8226	122	13031
Country of origin of the variety	U. K.	Liban	România
Species	*Vitis vinifera* L.	*Vitis vinifera* L.	*Vitis vinifera* L.
Pedigree as given by breeder/bibliography	Trollinger x Muscat de Alexandria	-	-
Pedigree confirmed by markers	Schiava grossa x Muscat Alexandria	-	Cardinal x Afuz Ali
Prime name of pedigree parent 1	Schiava grossa	-	Cardinal
Prime name of pedigree parent 2	Muscat Alexandria	-	Afuz Ali
Year of crossing	1850	-	1964
Last update	18.01.2017	18.01.2017	18.01.2017

Table 2. Phenological study of vine during blooming and development of fruits

Principal growth stage 6: Flowering (BBCH MODIFIED PHENOLOGICAL SCALE FOR COST ACTION FA1003)		
6.1: Beginning of flowering: 10% of flowerhoods fallen		
6.7: 70% of flowerhoods fallen		
Principal growth stage 7: Development of fruits		
7.1: Fruit set: young fruits begin to swell, remains of flowers lost		
7.7: Berries beginning to touch (if bunch are tight)		
I.Observation (30.05.2016) 70% of flowerhoods fallen	II. Observation (05.06.2016) Small-berry grape only formats	III. Observation (01.07.2016) Berries beginning to touch
		

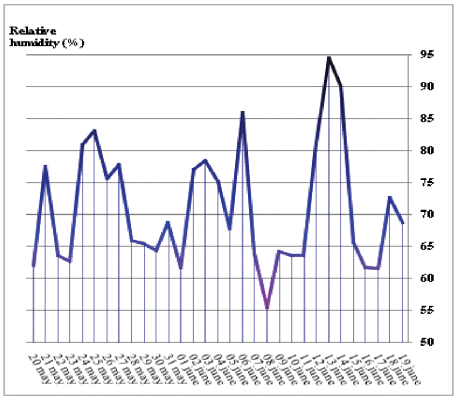


Figure 2. Evolution of the average relative humidity (%) for the period 20 May-20 June 2016

Analysing figure 4 which give details about size categories in which the formed berries belong, expressed as a percentage, it is observed that the Muscat Hamburg variety stands out with a great percentage of normal berries (65.9%), variety specific, followed by Victoria variety with 49.10% and then we find the Afuz Ali variety with a lower percent of 44.69%. It is surprisingly that even if the last varietes formed more berries in the process of fecundation, the proportion of berries remained very small (millet dimensions of 2-4 mm) and small (peppercorn dimensions 6-7 mm) was highly pronounced (55.24% and 51.07%).

All this results are affecting in a negative way the crops obtained (Table 3), literally, these shows a low productive potential, under the limit of these variety potential, which is given by the high percentage of very small and small berries remained.

A similar evolution was recorded in what concerns the average weight of a grape (220 g/grape - Muscat Hamburg cv., 270 g/grape - Afuz Ali cv. and 281g/grape Victoria cv.), determining a low yield, between 2.24-4.05 kg/vine, and the merchandise production in this case is being the lowest Stroe et al. (2016).

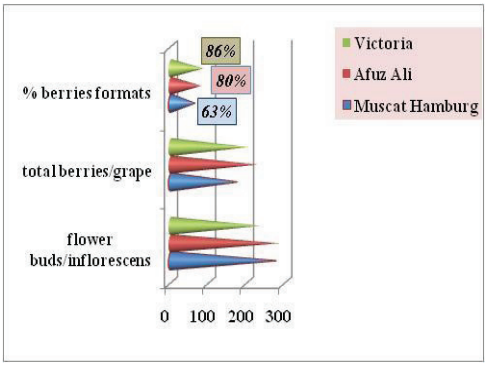


Figure 3. Evolution of the berries formats (%) for the period 20 May -20 June 2016

CONCLUSIONS

The average temperature and humidity values recorded in the blooming phenophase have left their mark on the three varieties studied, demonstrating through the obtained results that they are very pretentious and requires in this phenophase higher temperatures (over 20°C) and relative moist values of 65%.

Regarding the categories of the formed berries was recorded that Afuz Ali and Victoria varieties although formed much more berries, about half of them remained small (6-7 mm) and very small (2-4 mm).

Although Muscat Hamburg is known as a variety with millerandage problems in the given conditions of 2016, this was exceeded in this particular study of Afuz Ali and Victoria varieties, Victoria and Afuz Ali varieties are having in its pedigree Cardinal variety.

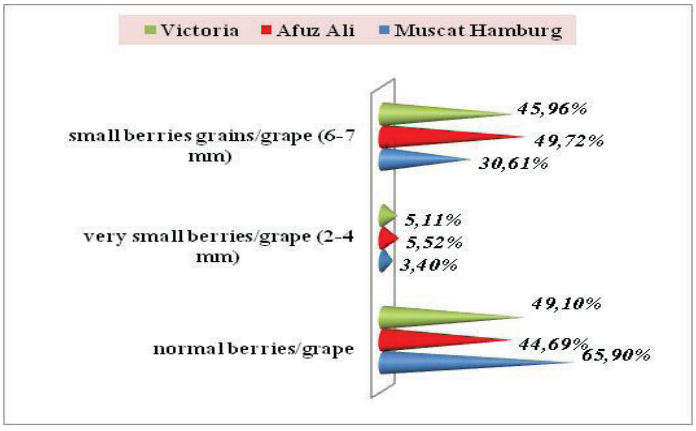


Figure 4. Evolution of the categories of grains formed of studied varieties

Table 3. The synthesis of the main fertility elements and physical characteristics of varieties study

Varieties	% fertile shoots	Absolute fertility coefficient	Relative fertility coefficient	Absolute productivity index (g/shoot)	Relative productivity index (g/shoot)	No. of grapes/vine	Average weight of a grape (g)	Yield (kg / vine)
Muscat Hamburg	58.33	0.91	1.57	200.2	345.4	11	220	2.42
Afuz Ali	61.11	0.83	1.36	348.6	571.2	15	270	4.05
Victoria	50.00	0.80	1.33	240	399	8	281	2.24

For an improvement, as a tehnological intervention, it can be applied several actions intervening on the sugar redistribution system: pinching fertile shoots a few days before blooming, annular incision below the inflorescence, application of growth retardant treatments, to briefly stop vegetative growth and redirect nutrients to inflorescences, balanced fertilization with potassium, which favors the sugars migration and accumulation of reserves, and also reducing nitrogen fertilizer rates.

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