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THE INFLUENCE OF THE CLIMATIC CONDITIONS ON THE WINTER BUDS VIABILITY AND FERTILITY OF THE VINE VARIETIES FROM ISTRIA VITICOL CENTER

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Abstract

The viability and fertility of the vine varieties from the plantations of Istria viticol Center were studied, according to the climatic conditions in the period of years 2017-2018. In the year 2017, the winter began gentle, with high temperatures for this time of year, in November was between +1 up to +12.3°C, and in December between minus 2.3°C up to +12.0°C. In the first half of January 2018, the temperature was positive (0-11°C), and in the second half, this decreased to a minimum of minus 20°C on January 28. In February 2018, the temperature was extremely low, between minus 22°C on February 2-nd and minus 20.5°C on February 10. Before the frost, from January 20, in the laboratory of Horticultural faculty from Ovidius University, were analyzed the fruit shoots and found normal values of viability and fertility of winter buds, values characteristic of each analyzed vine variety, but shortly after freezing, were reanalyzed the shoots from the same varieties and we have seen that these have suffered lost of winter buds, the percentage being between 27-56.25 %. For this reason in spring, when the vine is cut, the lost buds must be properly compensated, for the production to be ensured.

Key words*: fertility, fruit shoot, viability, winter bud.*

INTRODUCTION

Any grape variety, manifests its economic usefulness through the features of fertility and productivity. Fertility, is the vine ability to form fruiting organs, as the first step in the formation of grape production (Oslobeanu et al., 1980; Olteanu, 2000). The fertility is determined in each spring, for practical purposes, before vine cutting, to establish the fruit load of the buds, the length of the fruit elements and allow to forecast the future grape harvest (Dobrei, 2003; Ion, 2009). The knowledge of the vines fruiting capacity, by buds categories and their positions on the annual shoot, allow us to take technological measures, which will increase the potential of fruiting of the vines. Climate changes have profound implications on the winter buds viability and fertility, on the grapes productions, high quality of wines and implicitly on the maintenance technologies of the vine plantations.

Generally, in the vineyard Istria-Babadag, the climatic factors levels develop according to the temperate-continental climate which presenting certain particularities related to the geographical position (located in the central-eastern area of Dobrogea, bordering of the Black Sea and the lake Razelm and near the Danube Delta) of the territory. Before the vine's fruit cutting the vinegrower checks the resitence of the annual vine shoots over the winter and the viability and fertility of the winter buds, to determine the vine cuting system. The viability of the winter buds and especially of the main bud, can be affected by temperatures of minus 20ºC - minus 25ºC, which exceeds the variety's resistance limits.

The buds viability can also be affected by temperatures of minus 8ºC - minus 10ºC, that appear after days with positive temperatures.

The vinegrower is interested of the winter buds, because they will generate fertile shoots usually (Oslobeanu et al., 1980; Dejeu, 2004; Bucur, 2011).

The study was carried out in the viticol period of 2017-2018 years in Istria viticol centre, from Istria-Babadag vineyard.

MATERIALS AND METHODS

The air temperature description (average, maximum, minimum) from November 2017 to Octomber 2018, used the data recorded with the own Wather Master 2000 weather station.
The viability and fertility evolution of the winter buds were studied to the following vine varieties existing in Istria viticol centre (from Istria-Babadag wineyard): 'Chardonnay', 'Muscat Ottonel', 'Sauvignon Blanc', 'Riesling Italian', 'Cabernet Sauvignon', 'Merlot' and 'Feteasca Neagra'.
Also in the plantation, it was verified how the annual shoots passed over the winter. The health of the annual shoots were checked by longitudinal cutting of the internode and node to see the state of diaphragm and leading tissues.
The control of the winter buds viability was carried out by the method of longitudinal cutting as follows: - in plantation by cutting them directly on the annual shoot; - in laboratory by reading sections under microscope, establishing in the same time the buds fertility.
Before the frost from January 20, three annual shoots in length of 12-15 winter buds from each vine variety were collected.
After the shoots have been cut, they are labeled (date, variety, vine plot, slope position) and brought in laboratory and kept for 2-3 days in water (Figure 1) for the winter buds enlarge their size (Irimia et al, 2007).

Figure 1. Vine annual shoots in water

To avoid confusion refering the position of the winter buds on the annual shoot, this was divided into three intervals: 1-4, 5-8 and 9-12 winter buds, in order, from the base of the shoot and there were extracted one by one and put on the table. Each winter bud was fixed in the Sambucus marrow so as not to be crushed (Figure 2). Using a new blade they were longitudinally sectioned in very thin sections, collected in a Petri dish with distilled water to prevent sections drying and than these were analyzed under the microscop to determine their viability and fertility.

Figure 2. Winter bud in the Sambucus marrow

The data, obtained from this study were analysed, interpreted and included in the tables and figures from the next chapter.

RESULTS AND DISCUSSIONS

The results regarding the climatic conditions are specific to each viticol year (Table 1). Analysing the data presented in table 1, which highlights the termal regim, can be appreciated that the period November 2017-October 2018, compared to the multiannual average, was a capricious one. In the year 2017, the winter began gentle, with high temperatures for this time of the year, in November was between +1 up to +12.3°C, and in December between minus 2.3°C up to +12.0°C. In the first half of January 2018, the temperature was positive (0-11°C), and in the second half, this decreased to a minimum of minus 20°C on January 28. In February 2018, the temperature was extremely low, between minus 22°C on February 2-nd and minus 20.5°C on February 10.
The evolution of negative minimum temperatures recorded in January continued to decrease and remained at negative values almost all February 2018.

Table 1. The thermal regim in the viticol year 2017-2018

Year	Month	Average monthly temperature		Absolute max. temp	Absolute min. temp	Σ of temperature degrees					
						Global		Active		Effective	
		Normal	2017-2018			Normal	2017-2018	Normal	2017-2018	Normal	2017-2018
2017	XI	7.2	5.5	16.0	-2.0	228.1	159.8	134.9	46.1	34.9	6.1
2017	XII	2.3	5.0	17.0	-4.2	255.1	152.7	24.2	12.0	3.4	2.0
2018	I	0.5	0.1	11.0	-20.0	4.1	3.2	2.6	0.0	0.6	0.0
2018	II	1.3	-2.2	9.0	-22.0	62.6	-66.3	14.7	0.0	2.7	0.0
2018	III	4.2	7.2	23.0	-3.0	125.6	218.3	41.3	128.2	9.3	28.2
2018	IV	10.5	14.6	28.6	-2.0	369.7	436.2	219.8	402.5	53.8	152.5
2018	V	16.2	19.7	31.0	8.4	513.7	612.7	513.7	612.7	203.7	302.7
2018	VI	20.4	21.3	37.2	12.6	620.1	754.7	620.1	754.7	328.1	454.7
2018	VII	22.6	28.1	38.2	13.1	726.3	868.6	726.3	868.6	416.3	558.6
2018	VIII	22.6	26.2	39.7	10.7	671.0	808.9	671.0	808.9	361.0	498.9
2018	IX	17.6	20.6	36.0	7.8	521.2	619.7	552.7	619.7	252.7	319.7
2018	X	12.0	16.7	30.0	0.9	373.1	506.9	311.4	484.0	81.4	204,0
Σ/year		126.9	162.8			4,470.6	5,075.6	3,832.7	4,737.4	1,747.9	2,527.4
Average/month		10.57	13.56								

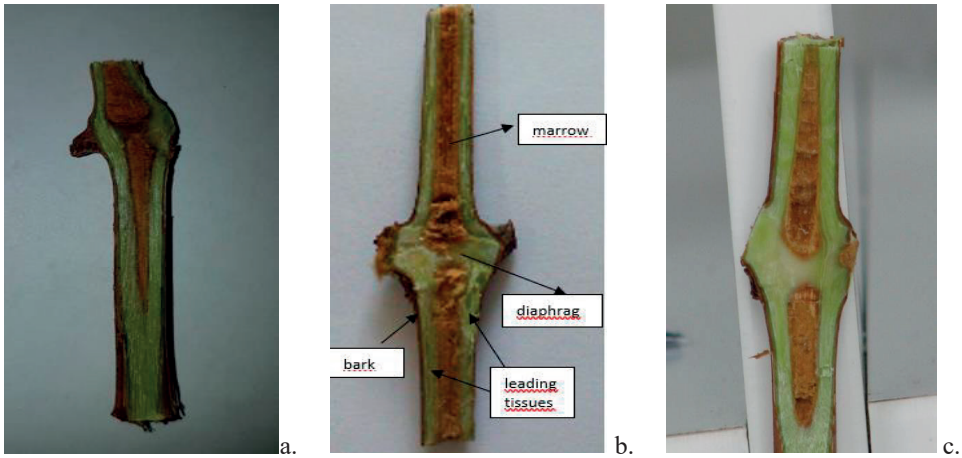
The beginning of March 2018, is a normal one for this period of the year, with positive daily average temperatures wich were not dangerous to the vines development.

Starting with March 15, temperatures between 10ºC up to 14.6ºC were recorded. Compared to the normal, amount of temperature degrees in March is with 92.7ºC higher, which favored the entry into the vegetation of the vine to earlier.

The sum of the temperature degrees for the period November 2017 - October 2018 was 5,075.6ºC compared to 4,470. 6ºC, with 605ºC more than normal. The maximum temperature recorded during this period was 39.7ºC (in August), and the minimum temperature recorded during the same period was minus 22ºC (in February).

The active temperature was 904.7ºC higher than the normal temperature, totaling 4,737.4ºC, compared to the normal temperature of 3,832.7ºC. And the effective temperature of these months amounted to 2,527.4ºC, compared to 1,747.9ºC to normal, with 779.5 more than this.

- Within the Istria viticol centre it was possible to analyze the annual shoots before freezing on January 20, 2018 and it was found that these were healthy, not frozen (Figure 3). The marrow brown colored and the bright green color of the diaphragm and leading tissues show us that the annual shoots did not freeze and were healthy.



a. b. c.

Figure 3. The annual shoots healthy- longitudinal section:
a - 'Merlot'; b -'Sauvignon Blanc'; c -'Riesling Italian' (original)

- The control of the winter buds viability in plantation

First, the winter buds viability was tested directly on the annual shoots in plantation and the results were that all of them were alive (Figure 4). Remember that in autumn, after the leaves fall, the axillary buds complex becomes winter bud, which is formed from: a main bud, 2 secondary buds (or replacement buds) and 2-4 tertiary buds, all protected from fluffy and scaly formations (Figure 4). All the above mentioned buds are fixed in a common tissue called meristematic zone or common generating area, which exist at the level of each node.

- The control of the winter buds viability and fertility in laboratory

This consisted in reading under microscope the sections made from the winter buds and the result was that the winter buds viability and fertility were characteristic for each analized variety (Figures 5, 6, 7, 8 and Table 2).

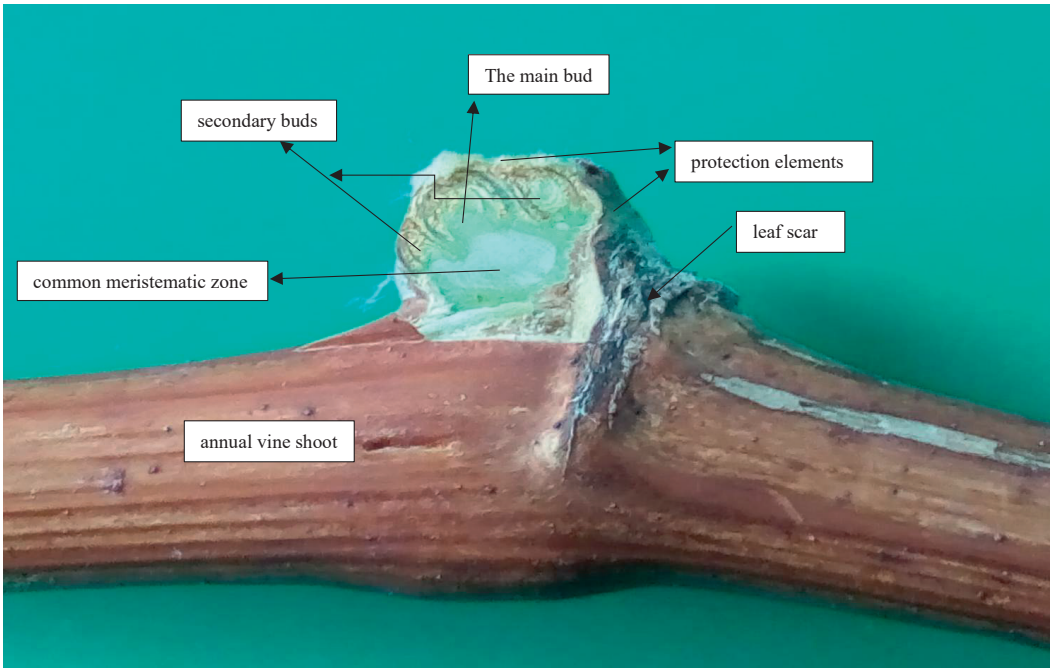


Figure 4. Viable winter buds on the annual shoot of 'Riesling Italian' variety (original)

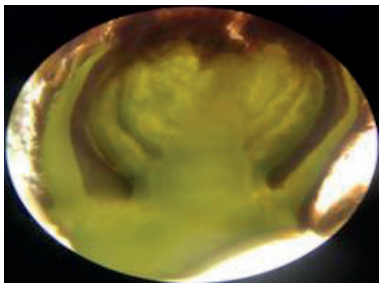


Figure 5. Main bud of 'Chardonnay' variety (original)

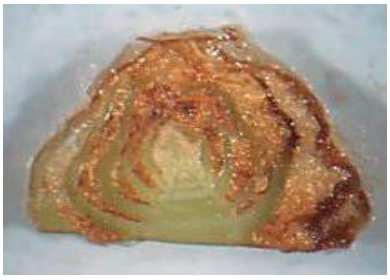


Figure 6. Main bud of 'Riesling Italian' variety (original)

Figure 7. Main bud and inflorescences primordia of 'Merlot' variety (original)

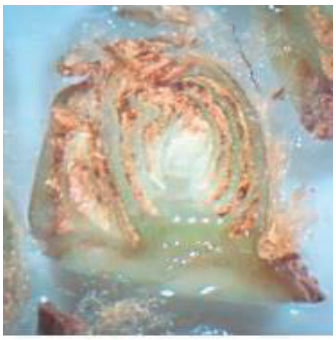


Figure 8. Main and secondary buds of 'Fetească Neagră' variety (original)

In the case of very severe winters, with very low temperatures, all buds (main, secondary and tertiary) of the winter bud are examined, in order to determine the possibilities of recovering the productive and vegetative potential of the vine variety. The losts of buds are expressed in percentages (% dead buds), taking into account the distribution of losses along the annual shoot (base, middle, tip), so that at cutting to reserve part of the shoot with the maximum percentage of viable winter buds (Dejeu, 2004) .

Generally, the best viability is recorded at the base of the annual shoot, where the buds are less developed, but more resistant to frost (Oslobeanu et al., 1980).

Table 2. Winter buds viability and fertility values in 2018 before freezing

No crt	Vine variety	Viability (%)/Fertility (%) in the interval winter buds:			X Average viability/ fertility	Normal fertility values %
		1-4	5-8	9-12		
Samples collected in 20.01.2018						
1	'Chardonnay'	41/32	94/68	56/57	64/52	50-60
2	'Muscat Ottonel'	74/68	100/82	100/83	91/78	75-83
3	'Riesling Italian'	75/65	80/74	45/68	79/69	80
4	'Sauvignon Blanc'	51/68	92/100	74/66	72/78	60-70
5	'Cabernet Sauvignon'	77/59	82/75	74/82	78/72	40-60
6	'Merlot'	84/93	83/92	82/49	83/78	60-80
7	'Fetească Neagră'	84/68	100/67	91/82	92/72	70-80

According to the data from the Table 2, the lowest viability/fertility was recorded at ‚Chardonnay' variety, on the interval 1-4 from the annual shoot base. The average fertility of the analyzed varieties was close to the normal value of the variety, sometimes exceeding it (eg. 'Sauvignon Blanc' variety).

After recording the absolute minimum temperatures harmful to the vines, the winter buds were reanalyzed, and a decrease of viability and fertility could be observed.

All the vine varieties in Istria viticol centre have suffered winter buds losts (Table 3).

In section the dead bud, analyzed under microscope, has a brownish-black color. Sometimes only the main bud of the winter buds is dead and the secondary are viable (Figure 9).

Other times, the main and secondary buds are dead and only the tertiary ones remain viable, other times the whole winter buds complex is dead (Figure 10).

Due to the small size and poor development of the winter buds, the tertiary buds are difficult to put in evidence in the sections.

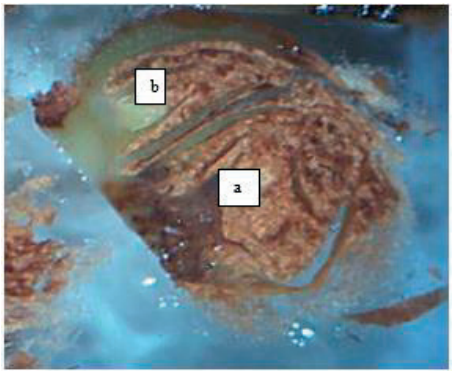


Figure 9. 'Fetească Neagră', main bud dead (a) and the secondary viable (b) (original)

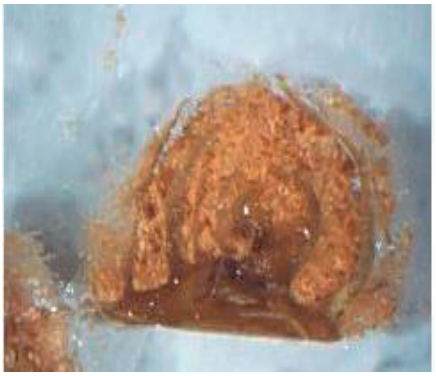


Figure 10. 'Cabernet Sauvignon'-All the buds are dead (original)

Table 3. Winter buds viability and fertility values in 2018 after freezing

No crt	Vine variety	Viability (%)/Fertility (%) in the interval winter buds:			X Average viability/ fertility	Normal fertility values %
		1-4	5-8	9-12		
Samples collected in 07.02.2018						
1	'Chardonnay'	7/0	43/52	57/31	36/28	50-60
2	'Muscat Ottonel'	9/7	41/44	24/24	25/25	75-83
3	'Riesling Italian'	58/52	68/46	36/41	54/46	80
4	'Sauvignon'	51/59	24/24	34/33	36/39	60-70
5	'Cabernet Sauvignon'	16/7	34/34	24/15	25/19	40-60
6	'Merlot'	15/17	34/16	66/24	38/19	60-80
7	'Fetească Neagră'	51/51	34/15	66/66	50/44	70-80

For all the analyzed varieties the viability and fertility losts of the winter buds were calculated and it was found that: viability losts were between 27.47-68.35% and fertility losts were between 24.35-66.66% (Table 4). For this reason in spring, when the vine is cut, the lost buds must be properly compensated, to ensure the production.

Table 4. The viability and fertility losses of the winter buds in Istria viticol centre in viticol year 2018-2019

No crt	Vine varieties	Average viability/ fertility before freezing	Average viability/ fertility after freezing	% losses	
				Viability	Fertility
1	'Chardonnay'	64/52	36/28	56.25	53.84
2	'Muscat Ottonel'	91/78	25/25	27.47	32.05
3	'Riesling Italian'	79/69	54/46	68,35	66,66
4	'Sauvignon'	72/78	36/39	50.0	50.0
5	'Cabernet Sauvignon'	78/72	25/19	32.05	26.38
6	'Merlot'	83/78	38/19	46.98	24.35
7	'Fetească Neagră'	92/72	50/44	54.43	61.11

CONCLUSIONS

As a biological material for the study of viability and fertility, during the viticol year 2018-2019, the vine varieties were used: 'Chardonnay', 'Sauvignon Blanc', 'Muscat Ottonel', 'Riesling Italian', 'Cabernet Sauvignon', 'Merlot', and 'Fetească Neagră', existing in the plantations from Istria viticol centre, situated in Istria-Babadag vineyard. The variable viability and fertility of the winter buds are influenced by environmental conditions.

The most important aspect for the vine fruit cuttings is to determine and reserve on each plant/m^2/ ha the correct number of winter buds

corresponding to the age and vigor, the environmental conditions and the qualities of the cultivated variety, to ensure the relationship between quantity and quality of the harvest.

This work is carried out every year in the Istria viticol centre, from December to March,

First, the control of the buds viability was done directly in plantation and than in laboratory by the longitudinal sectioning method, and the fertility was evaluated in the laboratory only.

Of the investigated varieties, all corresponded as fertility to the normal values established for them. All the data obtained by us provided information regarding the evolution of winter buds, the viability and fertility of the varieties and the position of buds along the annual shoots.

The data are important for determining the total number of winter buds retained on the vine plant after the fruit cuts.

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