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The Effect of low Air Temperatures on some Blackberry Cultivars over Winter Dormancy and transition from Dormancy to Vegetation

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Abstract: The investigation results of the influence of low temperatures of air and land on blackberry sorts like Black Satin, Cacanska bestrna i Darrow, in the period of winter inactivity and their transition from the inactive period into vegetation, are given in study. Investigating temperatures of air and land in the mentioned period are represented by diagram. Their influence on the investigating sorts are tabulated. The gain results of investigation fill in with statements of some authors that some sorts of blackberries can sustain low air temperature without great demages , to the -18°C in the period winter inactivity.

Key words: sort, winter inactivity, temperature, freezeness.

Introduction

Of all the environmental factors influencing blackberry, the most important ones are air temperature, rainfalls, wind and light.

Early autumnal frost frequently appearing in the continental conditions, when a bunch of cultivars, especially thornless haven't completed vegetation, damages blackberry most. (Soskic 1984).

Low winter temperatures could seriously damage blackberry cultivars, particularly when they passed into winter dormancy without being set, thus completing their vegetation before its time.

In our environmental conditions, more resistant blackberry cultivars bear frost without graver damages over the winter dormancy at the temperatures from –

10°C to -15°C, and if protected by a thicker snow layer they may tolerate of even up to –30°C (Evica Mratinic, 1998).

Milosevic (1997) pointed out that some blackberry cultivars could resist low air temperatures of even up to –30°C beneath snow and of up to –15°C to –18°C without snow.

Critical period for sensitivity of blackberry to low air temepratures is the transient phase from dormancy to vegetation. Hesitant temperatures from +6°C to –7°C occurring at the end of winter and at the start of the spring are especially inconvenient.

The objective of the paper was to study resistance to the impacts of low air temperatures and to those of soil within the particular time under sub-mountainous climate and higher altitude (750m).

The paper outlines the study results of the low temperatures affecting the individual pheno-phases during winter dormancy and over the transition from the dormancy into the vegetation (pheno-phases of budding, breaking of scaly leaves, bud opening and leafing).

All the meteorological factors (mean daily air temperatures, the average miniml and maximal ones, soil temperature in the layer 0-30 cm deep), were correlated with pheno-phases of the cultivars under way.

Materials and Method

The researches proceeded over the period 01.11.2002. – 15.04.2003. Air temperature (the mean daily, the mean maximal and minimal) and the mean daily soil temperature in the 0-30cm deep layer, were investigated.

The objective of the study was to find correlation between the pheno-phases and meteorological factors and to establish their effect on the blackberry cultivars.

The effect of low air temperatures and of soil on the cultivars in question was followed by taking the below- and above-ground plant parts (root and shoots) and by their anlysing in the laboboratory conditions. The samples were placed in the warm rooms of the 20°C of temeperature where the impact of the low temperatures was sought. The above-ground part was analysed through 10 and the below-ground part through 20 samples of the plants each.

Air temperatures measured by digital thermometer placed in the zone of shoots (at 1,5 m from the soil) at 7 am, 2pm and 9 pm. Soil temperature in the 30 cm deep layer was measured by geothermometer placed at 15cm deep soil with readings made at 7am, 2pm and 9pm.

Results and Discussion

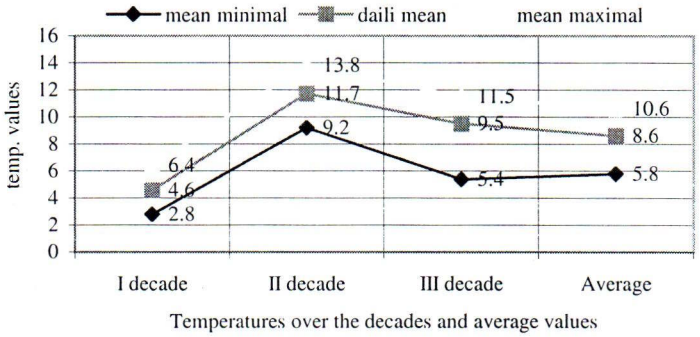
Winter dormancy period. Not many data about the dormancy period of blackberry have been drawn from practice and science so far (Soskic, 1984), whereas this phase in other species has been much more studied (Moroz, 1948; Weinberger, 1965; Stankovic, 1949 Stankovic, Jovanovic, 1981)

The results of the presently studied blackberry cultivars are presented in the tab.1.

Tab.1. The survey of the winter dormancy in blackberry cultivars

Cultivar	The start of winter	The end of winter	Duration of winter dormancy (days)
Čačanska bestrna	01.12.2002	12.03.2003	101
Blek satin	01.12.2002.	10.03.2003.	99
Derou	01.12.2002.	15.03.2003.	104

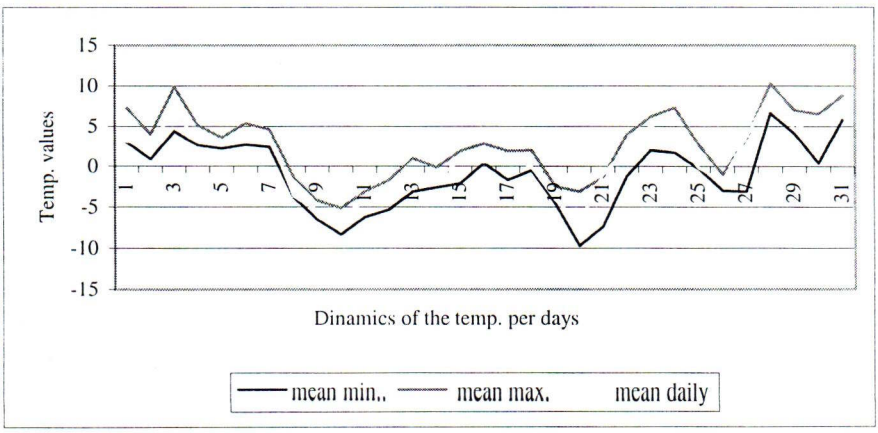
Fig.1. Air temperature ranges in November 2002.



Temperatures over the decades and average values

The study results (Tab.1) have shown the start, the end and duration of the winter dormancy to be differing. The longest period of the winter dormancy applied to Derou (104 days), and somewhat shorter one of 101days to Cacanska thornless and 99 days to Black satin.

Fig 2. Air temperature ranges in December 2002.

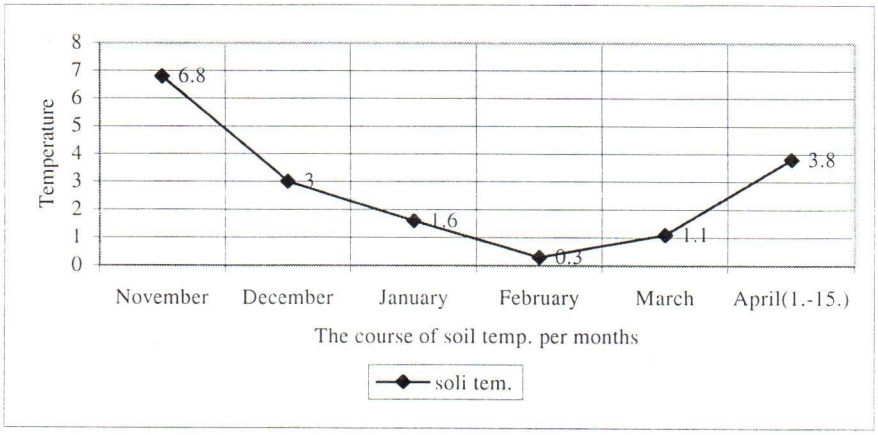


Dinamics of the temp. per days

When analysed, air temperatures (mean, daily, minimal and maximal) of November and December 2002 and soil temperature, winter dormancy was found to have taken place relatively late (the reason: relatively high air and soil temperatures in November 2002). Air and soil temperatures ranging trend in December (Fig. 2 an 3) visibly revealed the dormancy of plants in the 1. decade of Decemeber when the temperature values got steady below biological zero (5°C).

The duration and the end of the winter dormancy of the cultivars were found to vary, which may be attributed to the effect of the environmental factors and genetic base of the plants each.

Fig.3. The mean soil daily temperatures in the 0-30 cm deep layer for the period from 01.11.2002. – 15.04. 2003.



The effect of low air and soil temperatures over the winter dormancy

Study results of seeking the low air temepratures over the stated period are outlined in the tab. 2 and the survey of the absolutely minimal ones in the tab.3.

Study results of low air temepratures impact over the period in question and the dates of sampling plant parts are presented in the tab.2. The results obtained indicated the frost invading the unwooded sprouts in the cultivars Black Satin and Cacanska thornless. The frost on 02.02.2003. was explained by the absolutely minimal temperature registered on 13.01. 2003. (tab.3).

As can be seen from the table 3., the lowest absolutely minimal temperature over the winter dormancy measured in January amounted to –18,4°C.

Tab.2. The results of the low air temperatures impact on the plant parts (root, sprouts and buds) over the winter dormancy

Cultivars	Date of studying the plant parts	Study results		
		root	sprouts	buds
Black satin	15.12.2002.	-	-	-
	02.01.2003.	-	-	-
	02.02.2003.	-	*	-
	28.02.2003.	-	-	-
	10.03.2003.	-	-	-
	14.03.2003.	-	-	-
Cacanska thornless	15.12.2002.	-	-	-
	02.01.2003.	-	-	-
	02.02.2003.	-	*	-
	28.02.2003.	-	-	-
	10.03.2003.	-	-	-
	14.03.2003.	-	-	-
Derou	15.12.2002.	-	-	-
	02.01.2003.	-	-	-
	02.02.2003.	-	-	-
	28.02.2003.	-	-	-
	10.03.2003.	-	-	-
	14.03.2003.	-	-	-

Note: (*) registered frosted tips of unwooded shoots tied to the wire

Tab.3. The survey of the absolutely minimal temperatures over the period concerned

Temperature values (u °C)	November	December	January	February	March	April
	-4.0	-9.7	-18.4	-14.3	-10.0	-7.3
Date of measuring	11.11.02	20.12.02	13.01.03.	03.02.03	23.03.03	07.04.03
The time of measuring	21:00	07:00	21:00	07:00	07:00	07:00

Tab. 4. Pheno-phase of blackberry cultivars

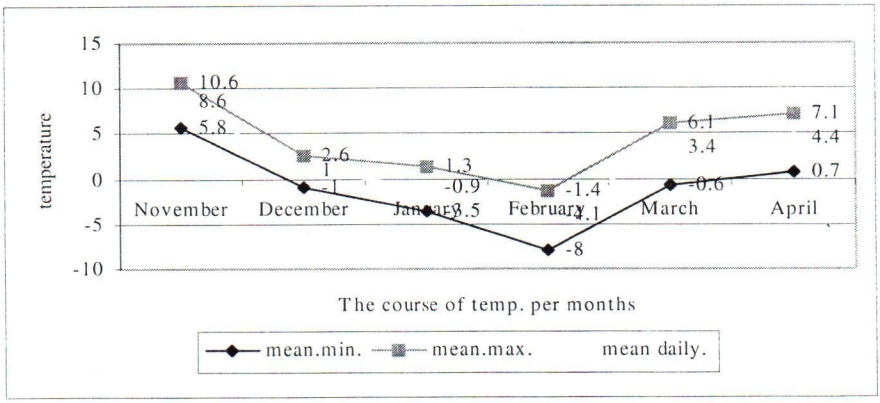
Cultivar	The start of budding	Breaking of scaly leaves and bud opening	Leafing
Black satin	10.03.03	25.03.03.	31.03.03.
Cacanska thornless	12.03.03	27.03.03.	01.04.03.
Derou	14.03.03	30.03.03.	04.04.03.

Tab.5. Study results of low air temperatures impact over the transiency from dormancy to vegetation of the cultivars

Cultivar	Date of sampling	Study results			
		The studied plant parts			
		Root	Sprouts	Buds	Yong leaves
Black satin Cacanska thornless Derou	01.04.2003	-	-	-	-
Black satin Cacanska thornless Derou	14.04.2003	-	-	-	-

Note: (-) no frosting registered

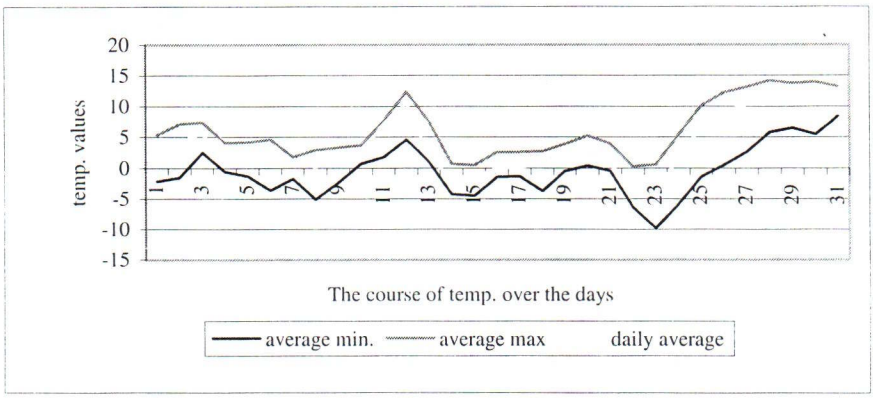
Fig. 4. Monthly temperature trend over the transience from dormancy to vegetation



It is clear from tab. 4 that the start of the stages varied from one phenophase to the other. The earliest start of budding was noticed in the cultivar Black Satin, and the latest one in Derou. The stage of leafing was the earliest in Black satin, and the latest in Derou. The highest difference in the beginning of this phase was 4 days in the cultivars studied.

The course of air temperatures (mean, daily, minimal and maximal) in March and in the first half of April (Fig. 5 and 6) and the results given in the tab.5 suggest no frosting of the studied plants.

Fig5. Air temperature ranges in March 2003.

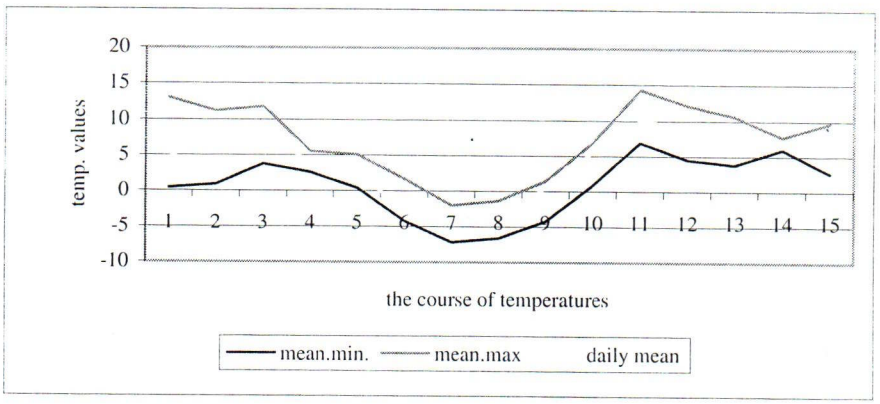


The air temperature trend (Fig. 5 and 6) in the period 24.03. to 05.04., shows the values ranging +5°C to +15°C that caused the outcome of leafing in the cultivars under way.

As can be seen from the Fig.6., the mean daily and the mean minimal air temperatures in the period 05.04. to 10.04 had negative values with the absolute minimum measured on 07.04. of –7,2°C. The tab.4 shows that, in that period, the

cultivars were in the pheno-phase of leafing and that no harmful effect of these temperatures was evidenced.

Fig.6. The air temperature trend of the first half of April, 2003.



Conclusion

The effect of low temperatures in the transient time from winter dormancy to vegetation on the blackberry cultivars brought about several conclusions:

- Over the winter dormancy, non-wooded shoot tips of the Cacanska thornless and Black satin could be correlated with the onset of the extremely low temperatures in January (-18,4°C) and genetically incited sensitivity of the cited cultivars to extremely low temperatures.
- The analysis of the sampled data and the course of temperature trend over the transition from winter dormancy to vegetation, has shown that no frosting of the cultivars occurred during that time (Absolute minimum in the pheno-phase of leafing in the cultivars amounted to –7,2°C).
- The present results are in agreement with those of the authors citing that blackberry cultivars may withstand low temperatures in the period of the winter dormancy from –10°C to –15°C or –18°C (Milosevic, 1987; Mratinic, 1998).

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UTICAJ NISKIH TEMPERATURA VAZDUHA NA NEKE SORTE KUPINA U PERIODU ZIMSKOG MIROVANJA I PRELASKA IZ MIROVANJA U VEGETACIJU

-originalni naučni rad -

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Rezime

U radu su dati rezultati istraživanja uticaja niskih temperatura vazduha i zemljišta na sorte kupina Blek saten, Čačanska bestrna i Derou, u periodu zimskog mirovanja i prelaska iz mirovanja u vegetaciju. Ispitivane temperature vazduha i zemljišta u navedenom periodu predstavljene su pomoću dijagrama a njihov uticaj na ispitivane sorte, tabelarno. Dobijeni rezultati istraživanja slažu se sa navodima nekih autora da pojedine sorte kupina mogu podnijeti niske temperature vazduha u periodu zimskog mirovanja i do -18°C bez većih oštećenja.