WATER DEFICIT AND ITS EFFECT ON PHYSIOLOGICAL MANIFESTATIONS IN SELECTED VARIETIES OF CAULIFLOWER (*BRASSICA OLERACEA* VAR. *BOTRYTIS* L.)*

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The effect of short-term and long-term water stress was studied in cauliflower (*Brassica olerarcea* var. *botrytis* L., the varieties Opaal, Ambition, Spacestar, Siria and Fremont) as affected the rate of photosynthesis (P_N), rate of transpiration (E) and stomatal conductance (g_s) in the years 2000 and 2001. Plants of cauliflower were cultivated in the greenhouse (average temperature 20/16 °C day/night) in pots 120 mm in diameter in the control (C) (watering on the level of 30% volume of soil moisture, what means the value of soil water potential –0.12 MPa, at pH 7.0) and the stressed variant (S). Watering was discontinued for five days in stressed plants in short-time water stress and in long-time water stress watering was reduced to 17% of the volume of soil moisture for 22 days, i.e. soil water potential was –1.28 MPa. With passing water stress stomatal conductance was falling together with the rate of photosynthesis and transpiration. The rate of photosynthesis ranged between 11.9 and 39.4% on the fifth day of dehydration of the rate of photosynthesis of the control plants. The difference in the rate of photosynthesis between the control and stressed plants on different dates of measurement was statistically significant ($F = 22.3195$, $p = 0.000167$, Table 3, Fig. 3). The variety Opaal was most resistant and the variety Ambition was most sensible. The rate of photosynthesis in stressed and control plants was equal on the third day of rehydration. We did not record the values comparable with control plants to the end of experiment in stomatal conductance and the rate of transpiration. Resistance of cauliflower plants to water deficit was recorded in long-time action on the 10th day of dehydration when stressed plants reached the values of the rate of photosynthesis on the level 50.2 to 73.2% of the control plants. Zero value of stomatal conductance was taken on the 17th day of dehydration in all varieties, except the variety Fremont (0.009 mol $CO_2.m^{-2}.s^{-1}$). The differences between stressed and control plants were statistically significant ($F = 11.605$, $p = 0.000129$, Table 5, Fig. 5). Stomatal transpiration (0.28 mmol $H_2O.m^{-2}.s^{-1}$) was preserved for the whole time of action of water stress in the variety Fremont. The rate of photosynthesis taken on the second day of rehydration was measured in stressed plants ranging between 73.7 and 84.2% of photosynthesis of control plants. The variety Fremont seemed to be the most resistant variety to long-time water deficit, and the varieties Siria and Spacestar were the least resistant.

water stress; cauliflower; *Brassica olearacea* var. *botrytis*; varieties; rate of photosynthesis; rate of transpiration; stomatal conductance

INTRODUCTION

The sufficiency of water during the growing season is one of the basic prerequisites of yield formation in economically important crops. Cauliflower plants are during the growing season more demanding out of cabbages for amount of water. The greatest demand for sufficiency of water has the cauliflower in the period of maximal growth of rosettes before harvest and its deficit results in premature establishment of low-quality rosettes that become to be unmarketable. As reported Nacentov (1955) cauliflower needs 60 l of water to produce 1 kg of biomass and 182 l of water for 1 kg of rosettes. Nowadays (the situation of 2001) 85 cauliflower varieties are registered in the list of approved varieties of different provenance. Seed distributors do not give complete data on some varieties concerning demand and requirements of the plants of cauliflower under Czech conditions that are frequently different from the site of origin of different cauliflower varieties.

Yield-forming components are in field conditions formed by common action of internal and external factors that can be influenced by suitable cultural practices. Water belongs to very important factors of external medium that in final consequence decides in a decisive way on the level of the yield. The stress caused by water deficit affects the basic life function of plant, it can damage different organs and in the last resort it can lead to the death of plant.

Stress caused by water deficit in plants is firstly manifested by deceleration of elongating growth (Hsiao, 1973), what is caused by loss of turgor. Turgor in starting stress in the growing zone is preserved and the deceleration of the growth is caused by the change of properties

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of cellular walls or by disappearing of gradient of water potential necessary for transport of water into cells (Barlow, 1986; Nonami, Boyer, 1989). Decrease of the growth results in lower consumption of assimilates and in their accumulation in leaves.

Based on the present knowledge it can be said that photosynthetic and enzymatic apparatuses are relatively stable at the beginning of water deficit (Cornic, Briantais, 1991; Cornic et al., 1992). If water deficit does not exceed 30% of full saturation of tissues, photosynthesis is limited by closing of stomata due to ABA accumulation in clamping cells of stomata (Chaves, 1991).

Non-stomatal limitation of photosynthesis occurs by further deepening that consists in lower activity of photosystem II (PS II), damage of its reaction centre, inhibition of activity of ATP-synthetase and in changes of electron transport (Baker, 1993; Cornic, Massacci, 1996), further in decrease of concentration and activity RUBISCA (Chaves, 1991).

The way of protection stress due to water deficit is in majority of terrestrial plants in avoidance of dehydration. Mechanisms of avoidance can be concentrated on limitation of water consumption – closing of stomata, rolling of leaves, falling of leaves, decrease of growth and shortening of ontogenetic development or for providing of water consumption – osmotic accommodation (Lewitt, 1980).

The course of stress reaction and its final result depend on both intensity and length of action of the stressor on the given plant and on genetically bound prerequisites of the response, called in total as adaptation abilities (Procházka et al., 1998).

The target of the experiment was to evaluate the changes in the rate of photosynthesis, transpiration and stomatal conductance under the influence of short-time and long-time water deficit and subsequent rehydration in selected varieties of cauliflower.

MATERIAL AND METHOD

Experiments concentrated on the study of short-time and long-time effects of the stress induced by water deficit were performed in glasshouse conditions (average temperature 20/16 °C day/night) as affected physiological manifestations in selected cauliflower varieties (Opaal, Ambition F1, Spacestar F1, Fremont F1 a Siria F1) in the years 2000 and 2001. The plants were cultivated on homogenized soil in pots with 120 mm in diameter. The trials were established in two variants: control variant (C) and stressed one (S) in the phase of five right leaves. Watering of control plants was 31% of the volume of soil moisture during the trial, what represents the value of water potential –0.12 MPa, at pH 7.0.

Watering was discontinued for five days in short-time action of water stress in stressed plants. After elapsing of this time stressed plants were watered in the same way like the control. Four measurements were done in selected physiological characteristics (3rd and 5th day of dehydration and 2nd and 3rd day of rehydration, abbreviated as 3d, 5d, 2r a 3r) during the trial.

When studying long-time effect of water stress, watering was reduced in stressed plants for 22 days. Stressed plants were irrigated by lower dose of watering to the level of 17% of the volume of soil moisture, i. e. water soil potential –1.28 MPa. Irrigation in the variant drought was done always after reaching the wilting point and soil moisture was always lower even after watering – the control of percentage content of water was performed by electric sensor after relevant calibration. After elapsing of 22 days of stress, irrigation was again renewed. Five measurements of selected physiological characteristics were carried out during the trial (at the beginning of the trial, on 10th and 17th day of dehydration and 2nd and 8th day of rehydration, abbreviated as 0, 10d, 17d, 2r a 8r).

The rate of photosynthesis (P_N), the rate of transpiration (E) and stomatal conductance (g_s) were studied physiological characteristics. Portable infrared gasometric analyser LCA 4 was used. The measurement itself was performed in the climate-controlled box in three selected plants (irradiance of 540 $\mu mol.m^{-2}.s^{-1}$, temperature 20.5 °C, relative air moisture 60%) on the same leaf during the whole experiment. The device LCA 4 recorded the studied characteristics in one-minute intervals for 20 minutes. The collection of 10 measurements was chosen of this number of measurements when conditions inside the measuring chamber were more stable.

The measured values were statistically processed using the program StatSoft, Inc. (2001) – STATISTICA Cz [Software system for data analysis], version 6. The evaluation of itself was done using the multivector analysis of variance with the interactions of the second degree where variety, variant and date of measurement were chosen as categories of independent variables (factors).

RESULTS AND DISCUSSION

The measured values of the studied physiological characteristics in control and stressed plants of short-time and long-time experiment are presented in Table 1. On the third day of dehydration in cauliflower plants exposed to short-time action of water stress stomatal conductance fell significantly in all varieties compared with the control plants that falls, as reported by Čatský et al. (1985) in the stress caused by water deficit. The difference in stomatal conductance among the control and stressed plants on different dates of measurements was statistically significant ($F = 5.365$, $p = 0.021525$, Table 2, Fig. 1). The values of stomatal conductance were 0.035 mol $CO_2.m^{-2}.s^{-1}$ on average in stressed plants and in the control plants it was 0.120 mol $CO_2.m^{-2}.s^{-1}$. This trend continued with deepening of water deficit in such a way that on the fifth day of dehydration we measured in the variety Ambition zero stomatal conductance. The highest value of stomatal conductance was taken in the

Table 1. Measured physiological characteristics in cauliflower plants under short- and long-time effect of stress

		Short-time stress			
		3d	5d	2r	3r
Fremont C	P_N	14.31	12.51	13.29	11.38
	E	1.84	1.66	1.55	1.93
	g_s	0.12	0.11	0.09	0.14
Fremont S	P_N	7.35	3.46	6.09	11.37
	E	0.86	0.24	0.5	0.83
	g_s	0.04	0.01	0.03	0.05
Ambition C	P_N	13.38	11.07	11.42	11.79
	E	1.86	1.53	1.69	2.13
	g_s	0.13	0.10	0.09	0.17
Ambition S	P_N	5.39	1.32	8.44	12.15
	E	0.48	0.2	0.6	0.88
	g_s	0.02	0	0.03	0.05
Spacestar C	P_N	13.59	12.64	11.03	12.27
	E	1.5	1.4	1.35	1.73
	g_s	0.09	0.09	0.08	0.12
Spacestar S	P_N	6.69	3.76	9.96	10.93
	E	0.79	0.35	0.77	0.86
	g_s	0.04	0.02	0.04	0.04
Opaal C	P_N	14.79	13.47	12.57	13.05
	E	1.89	1.57	2.29	2.65
	g_s	0.14	0.11	0.15	0.23
Opaal S	P_N	9.74	5.31	13.03	12.32
	E	0.69	0.55	1	1.14
	g_s	0.04	0.03	0.06	0.07

		Long-time stress				
		0	10d	17d	2r	8r
Fremont C	P_N	12.3	14.75	15.27	12.67	8.68
	E	1.36	0.94	1.29	1.08	0.89
	g_s	0.11	0.07	0.08	0.09	0.062
Fremont S	P_N		9.74	5.47	10.67	6.90
	E		0.42	0.28	1.12	0.76
	g_s		0.03	0.009	0.08	0.04
Ambition C	P_N	11.38	10.29	10.86	9.81	8.22
	E	0.93	1.01	0.85	1.01	1.22
	g_s	0.06	0.07	0.04	0.10	0.09
Ambition S	P_N		6.16	3.86	7.06	12.59
	E		0.24	0.21	0.96	1.26
	g_s		0.01	0	0.09	0.09
Spacestar C	P_N	12.29	12.62	12.74	12.51	9.72
	E	0.94	0.85	1.02	1.00	1.04
	g_s	0.07	0.06	0.06	0.07	0.08
Spacestar S	PN		7.29	1.32	10.32	7.55
	E		0.81	0.11	0.99	1.11
	g_s		0.06	0	0.07	0.09
Opaal C	P_N	12.77	9.74	13.22	9.99	9.22
	E	1.17	0.69	0.81	1.07	1.17
	g_s	0.09	0.04	0.04	0.08	0.09
Opaal S	P_N		9.80	3.72	12.44	14.61
	E		0.78	0.19	1.05	1.03
	g_s		0.05	0	0.08	0.07
Siria C	P_N	12.02	9.6	11.99	10.62	6.37
	E	1.09	0.95	1.10	0.82	0.92
	g_s	0.08	0.07	0.06	0.05	0.06
Siria S	P_N		4.82	2.24	7.83	11.71
	E		0.19	0.16	0.64	0.66
	g_s		0.004	0	0.05	0.04

Legend: C – control variant, S – stressed variant, P_N – rate of photosynthesis in μmol $CO_2.m^{-2}.s^{-1}$, E – rate of transpiration in mmol $H_2O.m^{-2}.s^{-1}$, g_s – stomatal conductance in mol $CO_2.m^{-2}.s^{-1}$

variety Opaal (0.030 mol $CO_2.m^{-2}.s^{-1}$). No significant values were recorded among different varieties of the stressed variant in the values of stomatal conductance (Table 2, Fig. 5).

The rate of photosynthesis and transpiration, too, was falling gradually with deepening water deficit. The difference in the rate of photosynthesis among control and stressed plants on different dates of measurements was statistically significant ($F = 22.319$, $p = 0.000167$, Table 3, Fig. 3). When comparing the studied varieties the variety responded most sensitively by drop of the rate of photosynthesis of the variety Ambition and on the contrary, the highest rate of photosynthesis comparing the control plants was exhibited by the variety Opaal. On the fifth day of dehydration the rate of photosynthesis ranged in stressed plants on the level 11.9 to 39.4% of photosynthesis of control plants (the rate of photosynthesis in control plants 100%). The lowest rate of photosynthesis was in the variety Ambition (1.32 μmol $CO_2.m^{-2}.s^{-1}$), in which also due to zero stomatal conductance was only cuticular transpiration, and the highest rate of photosynthesis was in the variety Opaal (5.31 μmol $CO_2.m^{-2}.s^{-1}$).

After renewal of watering on the second day in the variety Opaal the rate of photosynthesis was balanced in both experimental variants. The rate of photosynthesis increased on the third day of rehydration to the level of control plants in all studied varieties. Such dynamic growth was not showed in stomatal conductance and the rate of transpiration. In these parameters during the experiment we did not record the values comparable with control plants. Average stomatal conductance on the third day of rehydration in stressed plants was 0.053 mol $CO_2.m^{-2}.s^{-1}$, what is one-third value of stomatal conductance of control plants. The rate of transpiration was in stressed plants on the level 41.3 to 49.7% of transpiration of control plants.

Before the start of long-time experiment proper we measured selected physiological characteristics in ex-

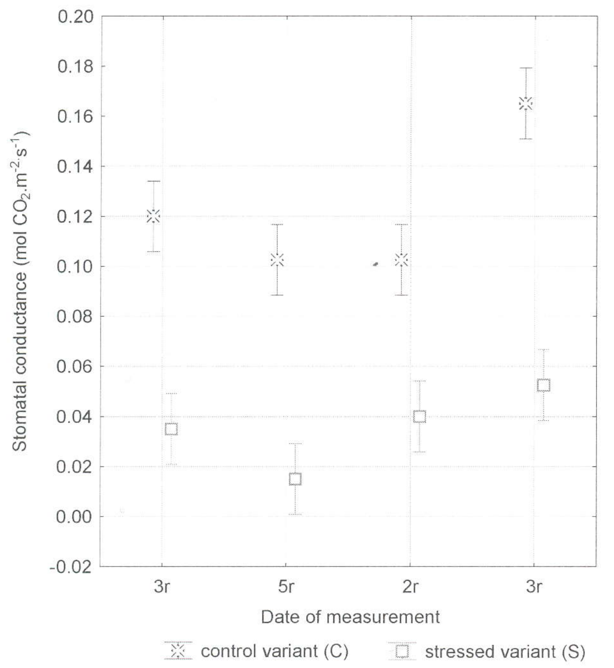

Fig. 1. Average stomatal conductance in studied variants on different dates of measurement; $F(3.9) = 5.3653$, $p = 0.02152$ – short-time stress

Legend: Vertical columns denote 0.95 intervals of reliability, 3d – 3rd day of dehydration, 5d – 5th day of dehydration, 2r – 2nd day of rehydration, 3r – 3rd day of rehydration

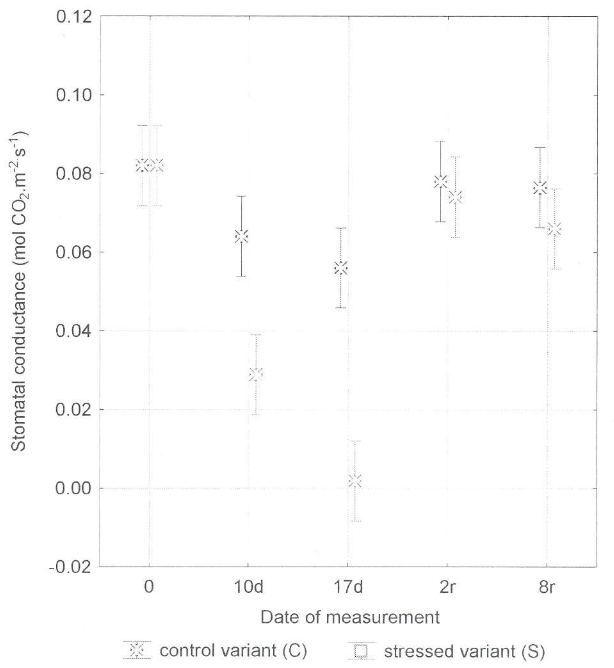

Fig. 2. Average stomatal conductance in studied variants on different dates of measurement; $F(4.16) = 11.605$, $p = 0.000130$ – long-time stress

Legend: Vertical columns denote 0.95 intervals of reliability, 0 – start of experiment, 10d – 10th day of dehydration, 17d – 17th day of dehydration, 2r – 2nd day of rehydration, 8r – 8th day of rehydration

Table 2. Table of semi-results and results of analysis of variance of double classification – stomatal conductance – short-time stress

	Sum of squares of deviations	Degrees of freedom	Variance	*F*	*p*
Variety	0.006909	3	0.002303	14.773	0.000801
Variant	0.060378	1	0.060378	387.281	0.000000
Date of measurement	0.010859	3	0.003620	23.218	0.000143
Variety x variant	0.002559	3	0.000853	5.472	0.020383
Variety x date of measurement	0.002653	9	0.000295	1.891	0.178272
Variant x date of measurement	0.002509	3	0.000836	5.365	0.021525

Legend: *F* – *F*-test, *p* – level of significance

Table 3. Table of semi-results and results of analysis of variance of double classification – photosynthesis – short-time stress

	Sum of squares of deviations	Degrees of freedom	Variance	*F*	*p*
Variety	28.769	3	9.590	6.879	0.010507
Variant	172.283	1	172.283	123.574	0.000001
Date of measurement	70.903	3	23.634	16.952	0.000480
Variety x variant	7.757	3	2.586	1.855	0.207646
Variety x date of measurement	6.693	9	0.744	0.533	0.818522
Variant x date of measurement	93.349	3	31.116	22.319	0.000167

Legend: *F* – *F*-test, *p* – level of significance

perimental cauliflower varieties in control variant (Table 1). Average rate of photosynthesis from the measured values in control plants was 12.15 μmol $CO_2.m^{-2}.s^{-1}$ and the rate of transpiration was 1.10 mmol $H_2O.m^{-2}.s^{-1}$. The first measurement of physiological characteristics was done on the tenth day of dehydration. The rate of photosynthesis in stressed plants fell compared with control plants. Differences in the rate of photosynthesis among control and stressed plants were statistically significant ($F = 26.460$, $p = 0.000001$, Table 4, Fig. 4). The

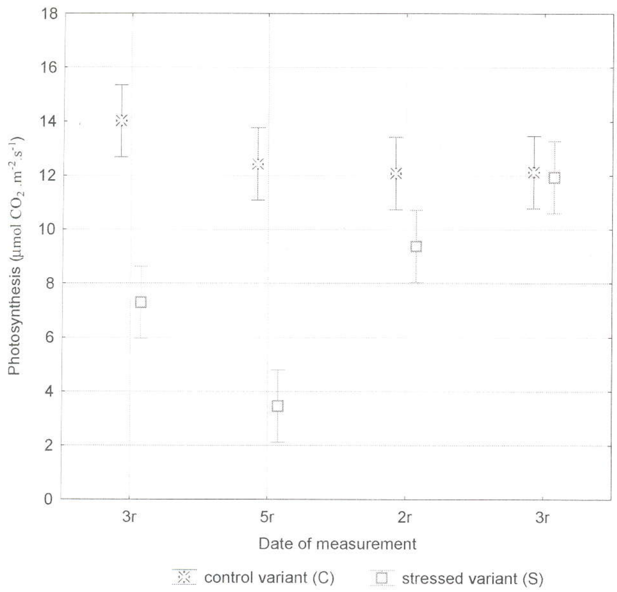

Fig. 3. Average rate of photosynthesis in studied variants on different dates of measurement; F (3.9) = 22.319, p = 0.00017 – short-time stress

Legend: Vertical columns denote 0.95 intervals of reliability, 3d – 3rd day of dehydration, 5d – 5th day of dehydration, 2r – 2nd day of rehydration, 3r – 3rd day of rehydration

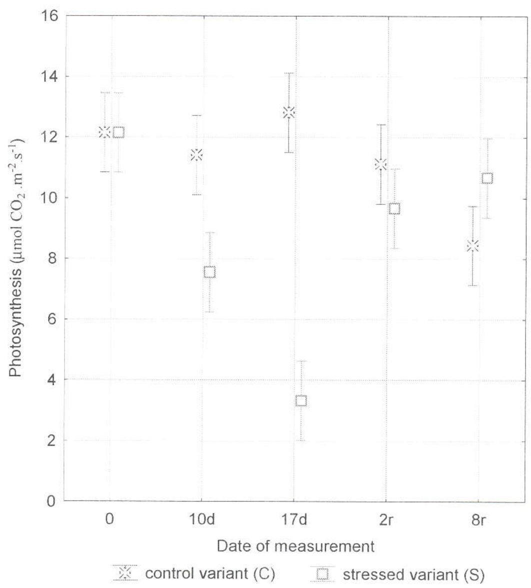

Fig. 4. Average rate of photosynthesis in studied variants on different dates of measurement; F (4.16) = 26.460, p = 0.000001 – long-time stress

Legend: Vertical columns denote 0.95 intervals of reliability, 0 – start of experiment, 10d – 10th day of dehydration, 17d – 17th day of dehydration, 2r – 2nd day of rehydration, 8r – 8th day of rehydration

Table 4. Table of semi-results and results of analysis of variance of double classification – photosynthesis – long-time stress

	Sum of squares of deviations	Degrees of freedom	Variance	F	p
Variety	33.111	4	8.278	4.354	0.014278
Variant	79.153	1	79.153	41.637	0.000008
Date of measurement	89.548	4	22.387	11.776	0.000119
Variety x variant	23.661	4	5.915	3.112	0.045083
Variety x date of measurement	52.359	16	3.272	1.721	0.143877
Variant x date of measurement	201.206	4	50.302	26.460	0.000001

Legend: F – F-test, p – level of significance

Table 5. Table of semi-results and results of analysis of variance of double classification – stomatal conductance – long-time stress

	Sum of squares of deviations	Degrees of freedom	Variance	F	p
Variety	0.001929	4	0.000482	4.173	0.016734
Variant	0.005387	1	0.005387	46.614	0.000004
Date of measurement	0.020136	4	0.005034	43.557	0.000000
Variety x variant	0.000739	4	0.000185	1.599	0.222839
Variety x date of measurement	0.007795	16	0.000487	4.216	0.003215
Variant x date of measurement	0.005365	4	0.001341	11.605	0.000129

Legend: F – F-test, p – level of significance

lowest decrease of the rate of photosynthesis from the start of long-time experiment was recorded in the variety Opaal, i.e. to the value 9.80 μmol $CO_2.m^{-2}.s^{-1}$, what means 73.2% compared with the control variant and in the variety Fremont 9.74 μmol $CO_2.m^{-2}.s^{-1}$ (66.03% of the control variant). The greatest fall of the rate of photosynthesis was in the variety Siria, i.e. to the value 4.82 μmol $CO_2.m^{-2}.s^{-1}$, what means 50.2% compared with control variant. In remaining varieties the fall of the rate of photosynthesis was ranging on the level 58.8% on average of the control variant. The rate of transpiration in stressed cauliflower plants too fell, only in the

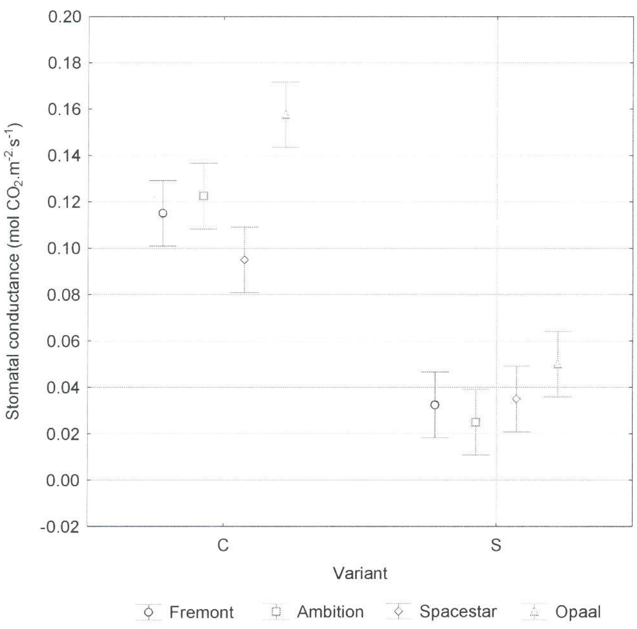

Fig. 5. Average stomatal conductance in studied variety on different variant; F (3.9) = 5.472, p = 0.02038 – short-time stress

Legend: Vertical columns denote 0.95 intervals of reliability, C – control variant, S – stressed variant

variety Opaal and Spacestar it reached the rate of transpiration of comparable values as in control plants. In remaining varieties it decreased to the level 20.0 to 44.7% of the rate of transpiration in control plants, while it was the lowest in the variety Siria.

Another date of measurement of physiological characteristics was on the 17th day of dehydration. In this phase of action of water stress zero value of stomatal conductance was taken in all varieties, except the variety Fremont (0.009 mol $CO_2.m^{-2}.s^{-1}$). Differences among stressed and control plants were statistically significant (F = 11.605, p = 0.000129, Table 5, Fig. 2). The rate of photosynthesis ranged in the studied varieties between 10.36 and 35.82% of control plants, while the highest value was recorded in the variety Fremont (5.47 μmol $CO_2.m^{-2}.s^{-1}$), followed by the varieties Ambition (3.86 μmol $CO_2.m^{-2}.s^{-1}$) and Opaal (3.72 μmol $CO_2.m^{-2}.s^{-1}$) and the lowest in the variety Spacestar (1.32 μmol $CO_2.m^{-2}.s^{-1}$). The rate of transpiration in stressed plants ranged in similar way between 10.78 and 24.71% of control plants. Regarding zero values of stomatal conductance, it was cuticular transpiration. Stomatal transpiration was preserved in the variety Fremont (0.28 mmol $H_2O.m^{-2}.s^{-1}$).

Compared with the response of plants to short-time water deficit, when on the fifth day of dehydration the rate of photosynthesis ranged between 11.9 and 39.4% in stressed plants. It is evident from photosynthesis of control plants that at longer action of water deficit (10th day) that the rate of photosynthesis was ranging between 50.2 and 73.2% of the rate of photosynthesis of control plants in dependence on variety. This can be explained by different phases of stress response when immediately after the start of action of stress factor alarm phase appears, when cellular functions are broken. Because water stress in long-time experiment did not reach the lethal level concerning the half-irrigation dose, compensation mechanisms were mobilised, i.e. restitution phase that directs to the increase of resistance to the stress factor – phase of resistance. It was manifested in cauliflower plants of all studied varieties by higher values of the rate of photosynthesis. Longer action of stress factor is replaced by the phase of exhaustion that was manifested on the 17th day of action of water stress by zero values of stomatal conductance and fall of the rate of photosynthesis and transpiration in cauliflower plants.

On the second day of rehydration the rate of photosynthesis was ranging in the stressed plants between 73.7 and 84.2% of control plants. The highest rate of photosynthesis was measured in the variety Opaal and the lowest in the varieties Ambition and Siria. After eight days of watering the rate of photosynthesis in the varieties Opaal, Ambition and Siria was reaching higher values than control plants, but on this date of measurement we recorded the fall of the rate of photosynthesis in control plants that can be apparently explained by ageing and partial damage to leaves used for the measurement.

Based on the experiments it can be said that there are differences among studied varieties in response to short-time and long-time effect on water deficit. When irrigation was sufficient, we did not record significant differences among varieties in the rate of photosynthesis. The variety Opaal seemed to be the most resistant in short-time effect of water stress and on the contrary, the variety Ambitions responded most sensitively to a short water deficit. Significant differences were not recorded in the rate of photosynthesis among varieties on the third day of rehydration ace. In long-time water deficit the variety Fremont seemed to be the most resistant, in which seed suppliers report resistance to stressed in cultivation. The variety Ambition together with Opaal were relatively resistant to long-time stress, despite the fact that it responded sensitively to short-time stress. The lowest rate of photosynthesis exhibited the variety Siria, for which seed suppliers recommended supplementary irrigation and the variety Spacestar, in which breeders recorded contradictory experience. After renewal of watering the most dynamic growth in the rate of photosynthesis was in the variety Opaal.

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Vodní deficit a jeho vliv na fyziologické projevy u vybraných odrůd květáku (*Brassica oleracea* var. *botrytis* L.).

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V letech 2000 a 2001 byl studován vliv krátkodobého a dlouhodobého vodního stresu u květáku (*Brassica oleracea* var. *botrytis*, odrůdy Opaal, Ambition, Spacestar, Siria a Fremont) na rychlost fotosyntézy (P_N), rychlost transpirace (E) a stomatální vodivost (g_s). Rostliny květáku byly pěstovány ve skleníku (průměrná teplota 20/16 °C den/noc) v nádobách o průměru 120 mm v kontrolní (zálivka na úroveň 31 % objemu půdní vlhkosti, což představuje hodnotu vodního potenciálu půdy –0,12 MPa, při pH 7,0) a stresované variantě. Při krátkodobém vodním stresu byla u stresovaných rostlin přerušena zálivka po dobu pěti dnů a při dlouhodobém stresu byla zálivka po dobu 22 dnů snížena na úroveň 17 % objemu půdní vlhkosti, tj. vodní půdní potenciál –1,28 MPa. S vyvíjejícím se vodním stresem se snižovala stomatální vodivost a klesala rychlost fotosyntézy a transpirace. Pátý den dehydratace se rychlost fotosyntézy pohybovala na úrovni 11,9–39,4 % rychlosti fotosyntézy kontrolních rostlin. Rozdíl v rychlosti fotosyntézy mezi kontrolními a stresovanými rostlinami v jednotlivých termínech měření byl statisticky průkazný (F = 22,3195, p = 0,000167, tab. 3, obr. 3). Nejodolnější byla odrůda Opaal a nejcitlivěji reagovala odrůda Ambition. Třetí den rehydratace se vyrovnala rychlost fotosyntézy u stresovaných a kontrolních rostlin. U stomatální vodivosti a rychlosti transpirace jsme do ukončení pokusu nezaznamenali hodnoty srovnatelné s kontrolními rostlinami. U dlouhodobého působení vodního stresu byla zaznamenána 10. den dehydratace odolnost rostlin květáku vůči deficitu vody, kdy stresované rostliny dosahovaly hodnot rychlosti fotosyntézy na úrovni 50,2–73,2 % kontrolních rostlin. Sedmnáctý den dehydratace byla naměřena u všech odrůd nulová hodnota stomatální vodivosti, kromě odrůdy Fremont (0,009 mol $CO_2.m^{-2}.s^{-1}$). Rozdíly mezi stresovanými a kontrolními rostlinami byly statisticky průkazné (F = 11,605, p = 0,000129, tab. 5, obr. 5). U odrůdy Fremont byla po celou dobu působení vodního stresu zachována stomatální transpirace (0,28 mmol $H_2O.m^{-2}.s^{-1}$). Druhý den rehydratace byla naměřena u stresovaných rostlin rychlost fotosyntézy v rozsahu 73,7–84,2 % fotosyntézy kontrolních rostlin. Jako nejodolnější odrůda dlouhodobému vodnímu stresu se ukazuje odrůda Fremont a jako nejméně odolné odrůdy Siria a Spacestar.

vodní stres; květák; *Brassica oleracea* var. *botrytis*; odrůdy; rychlost fotosyntézy; rychlost transpirace; stomatální vodivost

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