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THE POLLUTION EFFECT FROM PLANT OF KOSOVA IN TRANSPIRATION INTENSITY AND QUANTITY OF WATER IN LEAVES OF PLANTS *Pinus nigra* AND *Rosa canina*

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ABSTRACT

Mustafa, B. & Hoxha, E. (1998/99). The pollution effect from plant of Kosova in transpiration intensity and quantity of water in leaves of plants *Pinus nigra* and *Rosa canina*. Ekol. Zašt. Život. Sred., Vol. 6, No. 1/2, 29-34, Skopje.

In order to estimate the polluted environment influence in physiological processes of plants during 1989 observations of an intensity and daily dynamics have been done regarding transpiration and water quantity in leaves of plants *Pinus nigra* and *Rosa canina* in the polluted environment from Power plant in Obilić and in the clean environment in Grmija.

On the basis of achieved results there have been concluded that in the leaves in polluted environment of Obilić the transpiration intensity is essentially lower and water quantity is eddentially but water quantity is higher not only during the daily terms but even in the daily average.

Key words: transpiration, water quantity, intensity of sunny radiation, air temperature, relative humidity of air, pollution.

ИЗВОД

Мустафа, Б. и Хоџа, Е. (1998/99). Ефектот на загадувањето од термоцентралите на Косово врз интензитот на транспирацијата и вкупното количество вода во листовите на *Pinus nigra* и *Rosa canina*. Екол. Заштит. Живот. Сред., Том 6, бр. 1-2, 29-34, Скопје.

Извршени се истражувања во 1989 година за интензитетот и дневната динамика на транспирацијата и содржината на вода во листовите на *Pinus nigra* и *Rosa canina* со цел да се определи влијанието на загадувањето на животната средина врз физиолошките процеси кај растенијата. Истражувањата се вршени во загадена животна средина во Обилиќ и во чиста животна средина во Грмија.

Од добиените резултати е заклучено дека транспирацијата е значително помала во загадената средина во Обилиќ, а содржината на вода е повисока во различни периоди во денот како и дневниот просек.

Клучни зборови: транспирација, количество вода, интензитет на сончева радијација, температура на воздухот, релативна влажност на воздухот, загадување.

INTRODUCTION

It is known that living beings cannot be considered separately from the outside environment where they fulfil their living needs. The outside environment effects the organisms, therefore, they with their morphological, anatomical and physiological characteristics are in connection with differences which exist among different settlements.

For close connecion among morphological, anatomical and physiological characteristics of plants and the action of ecological factors in them show works of many authors: (Zalenskij 1904; Kramer 1959; Gračanin et al. 1969, 1971; Grupče & Mulev 1970; Dimitrijević 1985; Mustafa 1990; Hoxha & Mustafa 1995, 1996 and many others).

In the contemporary living conditions more and more the pollution of living environment is presented, wich influences the living beings, therefore, the plants as well. According to many results the pollution effects appear not only in anatomical characteristics of plants but also in their physiological procsses.

In order to have a clearer view how much the polluted environment influences physiological activities of plants, during 1989 the intensity and daily dynamics of transpiration and the water quantity in the leaves of species *Pinus nigra* and *Rosa canina* in the polluted environment of Obilić and the clean environment of Grmija have been conducted. Having in mind the importance of action of ecological factors, parallelly with the conduction of physiological parameters it was also carried out the measurement of settlements microclimate where the researches were done.

MATERIAL AND METHODS

As a research object the leaves of species *Pinus nigra* and *Rosa canina* have been used from the polluted environment in Obilić and the clean environment in Grmija.

The measurements of transpiration intensity are done according to Stocker (1929) method, by torsion weighing-machine with the sensivity of 2 mg. The conductions are done every two hours from 8 until 18, whereas the achieved values are presented in $mg \cdot g^{-1}/1'$.

The measurements of water quantity in leaves are as well done every two hours by desiccating method of leaves on 105^0 C up to the constant dry weight, whereas the achieved values are presented in percentage (%).

Measurements of microclimatic factors are also done every two hours, according to Janković (1957) method. In this work, in order to their influence in physiological processes, we have presented in tabular form only the intensity of solar radiation, temperature and relative air humidity.

RESULTS AND DISCUSSION

The achieved results during the measurements of transpiration intensity in species *Pinus nigra* and *Rosa canina* in Obilić and Grmija show that similarity exist, but also differences in daily course of this physiological parameter.

Even though the transpiration both in Obilić also in Grmija have had daily fixed dynamics, respectively with increase from morning hours towards those of noon and with decrease in afternoon and evening hours, wich was in conformity with daily oscilation rhythm of microclimatic factors (Tab. 1, 2), in spite of that there are differences in the intensity size of transpiration. In reality, the intensity of transpiration at the researched plants in Obilić, almost every day when the measurements were made was smaller not only in daily terms but also in the average daily values compared to those in Grmija (Tab. 3).

Tab. 1 Intensity of sunny radiation in $J \cdot cm^{-2} \cdot min^{-1}$
Таб. 1 Интензитет на сончевото зрачење во $J \cdot cm^{-2} \cdot min^{-1}$

Locality (локалитет)	Obilić (Обилиќ)						Grmija (Грмија)					
Time (време) Date (Датум)	**8**	**10**	**12**	**14**	**16**	**18**	**8**	**10**	**12**	**14**	**16**	**18**
10.06.1989	3.98	5.24	5.66	5.28	2.51	1.26	2.47	4.65	5.78	5.66	4.27	3.35
19.07.1989	2.18	3.18	4.69	5.03	3.02	1.47	1.55	2.81	5.20	5.45	3.85	2.35
29.07.1989	1.63	3.60	4.65	4.57	3.77	1.93	2.47	3.90	4.90	5.11	4.36	3.11
19.08.1989	1.51	3.98	3.44	4.32	1.93	0.21	1.68	4.06	3.60	4.27	2.43	0.29
29.08.1989	1.80	3.73	4.69	4.69	3.35	0.67	1.51	4.48	5.28	4.99	4.15	0.63

Though, as far as microclimatic factors concerned (Tab. 1 and 2) there were no big differences among settlements where the measurements were conducted, the lower values of transpiration intensity in Obilić were among other things also the result of great pollution of environment which is caused by chimney of power plants from which the released quantities of dust and gasses exeed permitted norms.

Tab. 2a Temperature
Таб. 2а Температура

Locality (локалитет)	Obilić (Обилиќ)							Grmija (Грмија)						
Time (време) Date (Датум)	**8**	**10**	**12**	**14**	**16**	**18**	**Average Средно**	**8**	**10**	**12**	**14**	**16**	**18**	**Average Средно**
10.06.1989	13.0	15.5	21.0	23.0	22.0	20.0	19.1	13.0	16.5	21.5	24.5	22.5	20.0	19.7
19.07.1989	16.0	22.0	25.2	26.0	25.0	23.0	22.8	19.0	23.5	25.5	27.0	24.0	22.0	23.5
29.07.1989	20.0	24.0	27.7	28.0	26.0	23.5	24.9	21.0	23.0	26.5	30.0	28.0	25.8	25.7
19.08.1989	14.0	19.5	20.5	23.0	18.5	15.0	18.4	14.0	19.5	21.0	22.5	20.0	18.0	19.2
29.08.1989	16.5	19.0	21.5	22.0	18.0	15.5	18.7	13.5	19.0	22.5	24.0	22.0	20.0	20.2

Tab. 2b Relative humidity
Таб. 2б Релативна влажност

Locality (локалитет)	Obilić (Обилиќ)							Grmija (Грмија)						
Time (време) Date (Датум)	**8**	**10**	**12**	**14**	**16**	**18**	**Average Средно**	**8**	**10**	**12**	**14**	**16**	**18**	**Average Средно**
10.06.1989	85.0	67.0	53.0	49.0	46.0	48.0	58.0	72.0	60.0	49.0	38.0	44.0	49.0	52.0
19.07.1989	86.0	77.0	63.0	47.0	47.0	53.0	62.1	80.0	71.0	59.0	48.0	51.0	53.0	60.3
29.07.1989	87.0	59.0	50.0	59.0	59.0	62.4	61.2	82.0	68.0	55.0	45.0	52.0	55.8	59.6
19.08.1989	86.0	72.0	56.0	53.0	74.0	82.0	70.5	80.0	67.0	59.0	52.0	68.0	80.0	67.7
29.08.1989	90.0	70.0	60.0	49.0	51.0	62.0	63.5	85.0	69.0	55.0	47.0	49.0	54.0	59.8

The influence of polluters, especially of dust and SO_2, the quantity of which, according to Shllaku (1995) is also up to 150 $ug \cdot m^{-3}$ daily and exeeds maximal permitted concentrations (MPC) is presented in covering of leaves and in obstruction of normal functioning of muzzles and with this also in intensity of transpiration, particularly in *Pinus nigra*.

For the action of polluters in plants are shown also in the results of other authors. Thus according to Glater et al. (1962) the accumulation of pollutants in leaves causes the congestion of muzzles or the damage of waxed

surfaces of leaves (Teyler and Murdu 1975). According to Hill and Littleefield (1969) also the increase of ozone concentration causes up to the parcial closing of muzzles, whereas Katz (1949) mentions that exposing of plants for a long time with SO_2 influences in the daily activity of muzzles. The influence of SO_2 is also manifested in the decrease of transpiration intensity (Rozhaja i Jablanović 1983).

Tab. 3 Daily values of transpiration intensity ($mg \cdot g^{-1} \cdot min^{-1}$) of species *Pinus nigra* and *Rosa canina* in polluted environment (Obilić) and in the clean environment (Grmija)

Таб. 3 Дневни вредности на интензитетот на транспирација ($mg \cdot g^{-1} \cdot min^{-1}$) кај *Pinus nigra* и *Rosa canina* во загадена средина (Обилиќ) и во чиста средина (Грмија)

Species Видови	Locality (локалитет)	Obilić (Обилиќ)							Grmija (Грмија)						
	Time (време) Date (Датум)	**8**	**10**	**12**	**14**	**16**	**18**	**Average Средно**	**8**	**10**	**12**	**14**	**16**	**18**	**Average Средно**
Pinus nigra	10.06.1989	2.9	4.8	2.6	1.8	1.4	0.8	2.4	5.0	5.3	6.8	5.3	4.1	1.2	4.6
	19.07.1989	3.4	3.9	3.6	3.3	2.3	2.0	3.1	4.6	7.1	6.7	4.6	3.8	23	49
	29.07.1989	4.0	4.3	6.6	3.6	2.1	1.9	3.75	5.3	5.8	7.8	7.4	4.8	3.7	5.8
	19.08.1989	3.1	4.7	6.9	3.7	2.8	2.6	4.0	4.4	7.5	8.0	4.7	2.8	2.4	5.0
	29.08.1989	3.3	3.9	4.9	3.0	2.9	1.8	3.3	3.7	4.2	6.8	5.2	5.1	2.1	4.5
Rosa canina	10.06.1989	12.0	18.1	20.2	12.2	4.9	2.3	11.6	14.2	16.9	18.3	16.7	16.1	2.5	14.1
	19.07.1989	7.1	13.9	15.7	7.2	6.7	6.7	9.7	9.5	14.9	15.6	15.0	12.7	8.6	12.8
	29.07.1989	3.5	10.3	16.1	21.4	9.7	7.4	11.4	5.6	10.4	16.1	22.3	10.6	8.9	12.3
	19.08.1989	9.8	15.8	18.3	18.9	9.0	4.0	12.6	9.7	16.9	20.6	23.5	7.7	5.2	13.9
	29.08.1989	9.3	9.9	18.5	10.7	10.7	7.0	11.0	9.8	10.1	18.9	14.4	11.9	7.2	12.1

Since in species *Rosa canina* the muzzles are placed only in the lower side of the leaves, they are not under direct influence especially of dust, therefore, also the differences in the transpiration intensity among the individuals of species *Rosa canina* in Obilić and Grmija are small. On the other hand, cuticular transpiration at *Rosa canina* is sufficintly intensive which is not the case in the species Pinus nigra, therefore, also the transpiration differences in *Pinus nigra* in Obilić and Grmija are greater and significant (Tab. 4).

Tab. 4 The significant values of transpiration and water quantity in leaves

Таб. 4 Сигнификантни вредности на транспирацијата и количеството вода во листовите

Locality (локалитет)	**Plant species (Вид растение)**	**Obilić (Обилиќ)**	**Grmija (Грмија)**
Transpiration ($mg \cdot g^{-1} \cdot min^{-1}$) Транспирација ($mg \cdot g^{-1} \cdot min^{-1}$)	Pinus nigra	3.3 ± 1.36 (29)	5.0 ± 1.80 (29)
Water quantity (%) Количество вода (%)	Rosa canina	11.4 ± 5.37 (29)	13.2 ± 5.23 (29)
Transpiration ($mg \cdot g^{-1} \cdot min^{-1}$) Транспирација ($mg \cdot g^{-1} \cdot min^{-1}$)	Pinus nigra	50.1 ± 3.35 (29)	48.4 ± 3.30 (29)
Water quantity (%) Количество вода (%)	Rosa canina	56.7 ± 3.35 (29)	55.6 ± 4.09 (29)

During all days when the researches were done in the transpiration intensity in both species in Obilić as well in Grmija, the higher values this parameter has achieved between the hours 10 and 14, whereas those minimal mainly at 18 (tab. 3) which was in connection also with daily movement of microclimatic factors, especially with temperature and relative air humidity.

The quantity of water in leaves of both species of researched plants during the day has conducted the transpiration intensity and was in indirect proportion with it, so, the greater quantity of water in leaves was at 8 and 18, whereas the smaller one was 12 and 14 (Tab. 5). Significant values were only in species *Pinus nigra* (Tab. 4).

Tab. 5 Daily values of water quantity in leaves (5) in species Pinus nigra and Rosa canina in polluted environment (Obilić) and in the clean environment (Grmija)

Таб. 5 Дневни вредности на количеството вода (%) во листовите на *Pinus nigra* и *Rosa canina* во загадена средина (Обилиќ) и во чиста средина (Грмија)

Species Видови	Locality (локалитет)	Obilić (Обилиќ)							Grmija (Грмија)						
	Time (време) Date (Датум)	8	10	12	14	16	18	Average Средно	8	10	12	14	16	18	Average Средно
Pinus nigra	10.06.1989	49.1	44.8	41.9	43.0	45.9	49.4	45.5	47.7	43.7	41.1	42.9	44.2	46.6	44.4
	19.07.1989	55.2	52.1	50.0	48.5	50.5	51.9	51.7	53.7	51.4	43.1	45.4	47.8	43.9	48.6
	29.07.1989	54.4	51.2	46.5	47.7	52.5	54.3	51.1	53.1	50.9	44.7	47.6	48.5	50.3	49.2
	19.08.1989	52.6	51.9	49.8	50.2	51.5	52.0	51.3	51.1	50.8	47.3	48.2	50.2	50.8	49.7
	29.08.1989	52.4	50.7	49.6	50.8	51.8	52.1	51.4	52.1	50.9	48.2	49.9	50.1	51.7	50.5
Rosa canina	10.06.1989	58.2	55.7	53.6	55.7	58.4	60.3	56.9	57.4	56.3	49.5	53.6	55.6	57.2	54.9
	19.07.1989	62.2	59.5	56.0	57.1	58.9	61.5	59.3	61.9	59.9	54.2	56.4	57.8	60.4	58.4
	29.07.1989	60.8	56.5	53.9	49.7	56.2	59.0	56.0	60.0	55.9	52.6	48.7	56.0	63.3	56.0
	19.08.1989	57.0	55.6	50.7	50.2	52.8	55.2	53.6	58.6	54.2	46.0	47.2	51.1	58.7	52.6
	29.08.1989	58.1	57.2	54.6	57.4	59.9	60.8	58.0	58.9	56.8	53.2	56.3	58.7	60.5	57.4

CONCLUSIONS

During the conduction of transpiration intensity and the general quantity of water in leaves in species *Pinus nigra* and *Rosa canina* in polluted environment in Obilić and the clean one in Grmija we have come to these conclusions:

1. Transpiration during the day both in Obilić and Grmija had a fixed daily dunamics. which means the higher values has achieved between hours 10 and 14, whereas those minimal ones mainly at 18.

2. Transpiration intensity in researched plants in Obilić almost in all days when the researches were done, was smaller compared to those in Grmija, wich shows clearly for the effect of great pollution wich is in Obilić.

3. In species *Pinus nigra* the differences between the transpiration intensity measured in Obilić and Grmija were greater and significant.

4. The greater quantity of general water in leaves was at 8 and 18, whereas smaller at 12 and 14, which is indirect proportion with transpiration process.

5. Significant values also for the general water quantity were only in Pinus nigra.

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ЕФЕКТОТ НА ЗАГАДУВАЊЕТО ОД ТЕРМОЦЕНТРАЛИТЕ НА КОСОВО ВРЗ ИНТЕНЗИТОТ НА ТРАНСПИРАЦИЈАТА И ВКУПНОТО КОЛИЧЕСТВО ВОДА ВО ЛИСТОВИТЕ НА *Pinus nigra* И *Rosa canina*

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Природно - математички факултет, Приштина, Косово, Југославија

РЕЗИМЕ

Во овој труд се презентирани резултатите добиени од мерењето на интензитетот и динамиката на транспирацијата и вкупното количество вода во листовите на растителните видови *Pinus nigra* и *Rosa canina*, во текот на вегетативната сезона во 1989 година. Истражувањето е извршено во загадената средина на Обилић и чистата средина на Грмија. Паралелно со физиоеколошките параметри, беше следена и микроклимата на живеалиштата каде што се одвиваше истражувањето.

Скоро во сите денови на истражувањето, интензитетот на транспирацијата кај растителните видови во Обилић беше помал во споредба со тој во Грмија. Со оглед на тоа дека факторот микроклима не се разликуваше многу во живеалиштата каде што се одвиваше истражувањето, ниските вредности на интензитетот на транспирацијата во Обилић, меѓу останатото, се резултат на големото загадување на средината од оцаците на термоцентралите. Количеството ослободена прашина и гасови, а особено на SO_2, ја надминува максималната дозволена концентрација (МДК) што резултира со покривање на листовите и спречување на нормалната функција на стомите. Ова особено доаѓа до израз кај видот *Pinus nigra*, каде што како интензитетот на транспирација, така и количеството на вкупна вода достигнуваата значителни вредности.