



Amminostim bio,  
1028

: Euroradix,

Technological parameters were not influenced by the application of the bioproducts, but rather depended on the meteorological conditions of the year and were within the limits of the genetic determination of the variety.

**Key words:** Euroradix, Amminostim bio, field beans, variety 1028

## INTRODUCTION

In recent years the market interest in environmentally friendly products with high nutritional and biological quality has been increasing. On the other hand it is required for the producers to apply good agricultural practices, particularly in the transition from integrated to organic production (Dochev and Atanasov, 2013). This increases the demand for opportunities to optimize the nutritional balance of plants by bioactivators.

It was reported in the literature that bioactivators influenced on the following metabolic processes: hormonal function with the effect of extending the cells and improvement of the suction root capacity (Scoccianti and Maini, 1981); better transport and assimilation of oligoelements (Stoyanov and Kudrev, 1981); feeding the plants with formation of proteins, amides and sugars (Maini, 1983). Also they had an important influence on the action of fungicides (Maas, 1983), and herbicides (Meriggi et al., 1992, Rapparini et al., 2003) expressed in optimizing (reducing) of the doses of application.

Up to now Euroradix and Amminostim bio bioproducts have been tested in nursery for grapevine (Lavezzaro et al., 2014.) and in sugar beet (Campagna and Brignoli, 2005).

Beans are very valuable, high protein food. The protein in its nutritional value is close to that of meat, fish and other animal products. It contains almost all essential -amino acids. Numerous tests, made in the country showed that

(Dochev and Atanasov, 2013).

(Scoccianti and Maini, 1981);

(Stoyanov and Kudrev, 1981);

(Maini, 1983).

(Maas, 1983)

(Meriggi et al., 1992, Rapparini et al., 2003)

Euroradix mminostim bio

(Lavezzaro et al., 2014.)

(Campagna and Brignoli, 2005).

beans is an excellent predecessor for all crops - as root crop provides loosening and cleansing the soil of weeds, the early harvesting of the crop gives the opportunity for timely and quality pre-planting treatment of soil, enriching the soil with nitrogen and rolling phosphorus. (Koinov, 1973).

Yield and technological qualities of bean seed are influenced by the heritable traits of the variety and growing conditions – soil, climatic and agrotechnical (Koinov and Radkov, 1981).

EuroRadix  
Amminostim bio

The objective of that study was the influence of EuroRadix bioactivator and Amminostim bio biostimulant to be tested in individual and combined application on yield and some technological traits in field beans.

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Yield and technological qualities of bean seed are influenced by the heritable traits of the variety and growing conditions – soil, climatic and agrotechnical (Koinov and Radkov, 1981). In this regard, consensus is missing among individual researchers regarding the use of fertilizers in beans.

The objective of that study was the influence of EuroRadix bioactivator and Amminostim bio biostimulant to be tested in individual and combined application on yield and some technological traits in field beans.

## MATERIAL AND METHODS

The study was conducted during the period 2013-2015 in the demonstration field of IASS “Obraztsov Chiflik”, Rousse, where 1028 bean variety was planted after oats predecessor. The experiment was started after the block method in 4 replications, the size of the harvesting plot being 10m<sup>2</sup>, including: 1. Control (untreated); 2. EuroRadix; 3. Amminostim bio; 4. EuroRadix + Amminostim bio; 5. EuroRadix + double application of Amminostim bio.

The soil type, where the experiment took place was strongly leached chernozem with low humus content – 1,75%, slightly stocked with mineral N (19,75 mg/1000 g of soil) and rolling P<sub>2</sub>O<sub>5</sub> (5,31 mg/100 g of soil) well stocked with K<sub>2</sub>O (22,75 mg/100 g soil). The soil reaction was moderately acid, pH – 5,2. The mechanical structure of the soil was heavy sandy clay (Vatralov, 1965; Nenova et al., 2011).

(1966).  
 Walter  
 10  
 Euroradix  
 N 4,1%.  
 (Glomus spp.,  
 Gigaspora, Rhizopogon, Trichoderma  
 spp., Bacillus spp.)  
 100 g/da,  
 mminostim bio  
 N 6% 38%  
 +

The sowing of beans was carried out in optimal technological period for the region. All agrotechnical activities in the test were made according to "Technology for growing of field beans" (Nemova et al., 2003), with the exception of mineral fertilization, that was not applied.

Data about the meteorological conditions during the study was registered in the automated meteorological station of IASS "Obraztsov Chiflik" - Ruse.

The graphical method of Walter (1966) was used for the assessment of droughtness during the vegetation period of beans. In that method, on one and the same scale the precipitation and double value of the air temperature were placed. The periods where the curve of precipitation fell under the curve of temperature were accepted as periods of droughtness. Periods taken into account were those that were longer than 10 days. In the study, the method has been modified for the calculations by ten-day periods.

Euroradix is a powdered bioactivator of natural origin, with a content of N of 4,1%. It is compost from plant materials which contains natural enzymatic components (cellulase, hemicellulases, alpha-amylases, beta-amylases, pentosanases, gluco-amylases, proteases, phosphorylases, etc.), useful microflora (Glomus spp., Gigaspora, Rhizopogon, Trichoderma spp., Bacillus spp.) and oligo-peptides (causing growth of microbes of natural origin), carbohydrates and minerals. It was applied at the time of sowing at a dose of 100 g / da.

Amminostim bio is a liquid bio-stimulator, containing 6% N and 38% amino acids (arginine, glutamic acid, alanine, isoleucine, histidine, phenylalanine, aspartic acid, threonine, methionine, serine, cysteine + cystine, tryptophan, valine, lysine, tyrosine, aminobutyric acid ). It contains nutritional

250 ml/da

1028

- 20

(1957)

60g,

1000

24 h

Tretyakova

Ustinova (1937),

- and enzymatic factors in active forms, as well as biostimulants in natural state. It was applied at a dose of 250ml/da in variant 5 once, and in variant 6 twice – first treatment in the begging of flowering, the second one – 20 days later.

1028 variety is of large and semiflat type, with low spread bush and lower-lying pods, which makes it unsuitable for mechanized harvesting. Regarding the vegetation period, the variety is late. Due to its good market qualities, excellent taste and good productivity the variety was the most grown in the country for more than twenty years.

- Boiling time of the seed in minutes was measured after the method of Popov (1957) using the apparatus for boiling PR-1 on a sample of 60g, the coefficient of water absorption – by weight – via soaking of 1000 seeds for 24 h in water at room temperature, the percentage of seed cover by Tretyakova and Ustinova (1937), taste qualities according to six-point scale by degustation.

**RESULTS AND DISCUSSION**

2013 .

( 1).

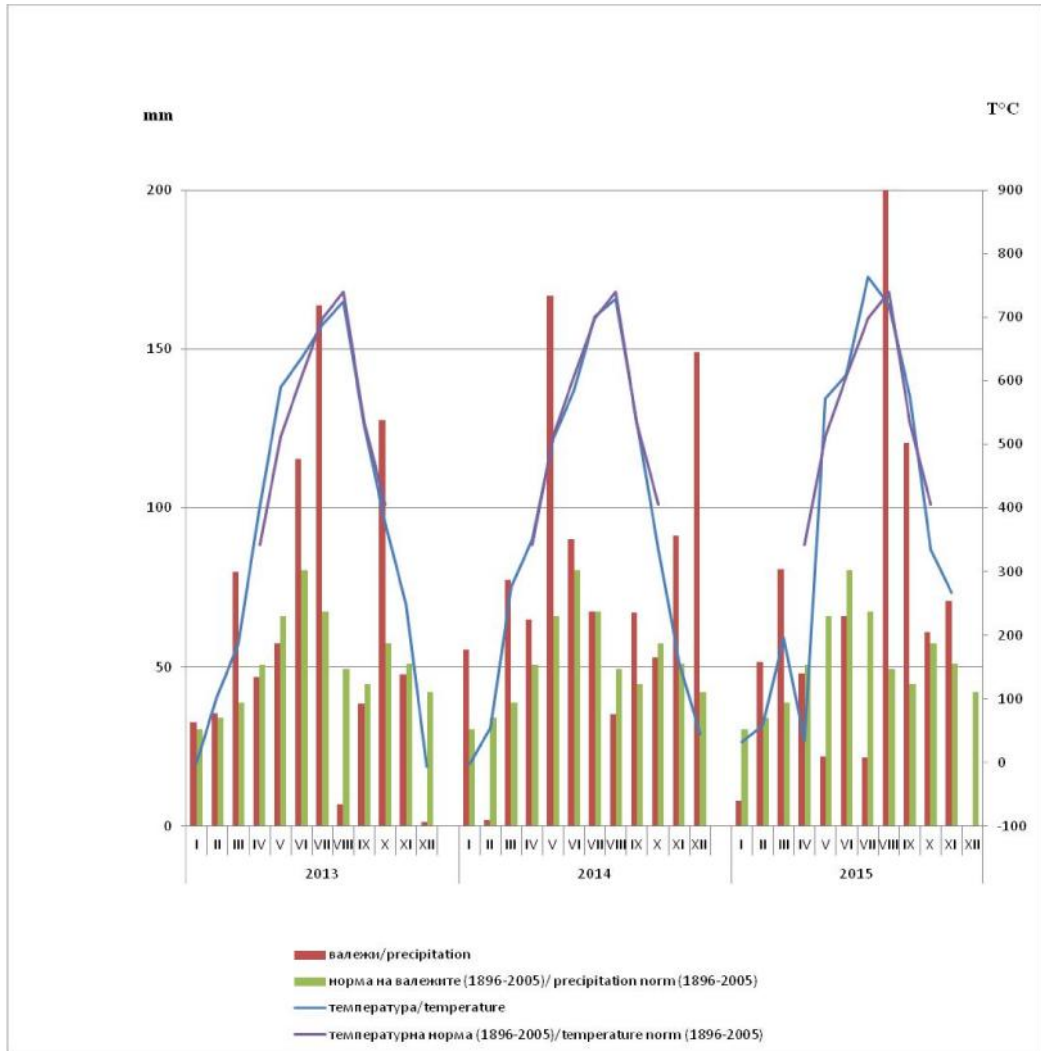
109 mm

- Comparising the meteorological conditions during the years of study and those during a multiannual period, it could be seen that there were variations as of the average monthly temperatures, so and in terms of the moisture providing (Figure 1). In 2013 the most favorable combination of temperature and precipitation was observed, especially during the critical months for beans - June and July (flowering and filling the pods from the lower floors). The second year of study was highly contrast to the period of sowing-emerging.

- The conditions in April-May contributed to a slower and ununiform emerging. In the last two days of May intense rain of 109 mm, accompanied with hail, stressed the plants, already developed, and led to thinning the crop. In the other months of

- vegetation, conditions were favorable for the normal development of beans and good yield formation.

2015 . The vegetation period of 2015 stood out as the most dry, with the lowest value of precipitation, as in every month it was below the norm, at temperatures above the norm (Figure 2).



1. 2013-2015 .  
**Fig. 1 Climatic characteristics, 2013-2015**



Euroradix	=5%
Amminostim bio	( =0,1%).
bio	Amminostim

All studied variants exceeded the yield of the control as absolute values in the three years of study. The difference in yield between the control and the variant with individual application of Euroradix been was significant at P = 5% in the first year of the experiment and during the next two years it was not proven.

The individual application of Amminostim bio during the three years of study led to yield increase, as the difference with the control was very well proven (P = 0.1%).

Very well proven were the differences between yield of control and variants with combined application of the both bioproducts during the three years of study, as the variant with double application of Amminostim bio showed best results.

### 1.

**Table 1. Yield of field beans in application of bioproducts**

Variant	/ Yield						Average yield	
	2013		2014		2015		kg/d	%
	kg/da	%	kg/da	%	kg/da	%		
1 / Control	107	100,0093	100,0087		100,00	95,7	100,00	
2Euroradix	116 +	108,9594	101,0891		105,75	100,3	104,81	
3Amminostim bio	131 +++	122,77118	+++129,88113		+++129,89	120,7	126,12	
4Euroradix + Amminostim bio	143 +++	133,55123	+++132,26119		+++136,78	128,3	134,06	
5Euroradix + 2 x Amminostim bio	156 +++	146,20137	+++147,31128		+++147,13	140,3	146,43	
/Average	130,6		113		107,6			
<b>GD:kg/da</b>								
<b>5.0%</b>	<b>9</b>		<b>11</b>		<b>5</b>			
<b>1.0%</b>	<b>13</b>		<b>16</b>		<b>7</b>			
<b>0.1%</b>	<b>18</b>		<b>22</b>		<b>9</b>			

125	140 min
2013	
1 min	
Euroradix.	
min	2014 . 3 min
	2015 .

Boiling time of the seeds was from 125 to 140 min in different variants in the three years of study. In 2013 it was one and the same of the control and studied variants, as a difference only of 1 min was registered only in the variant with individual application of Euroradix. In the next years again the same variant exceeded the control by 2 min in 2014 and by 3 min in 2015, respectively.







3. climatic conditions during each year of the three-year period of study
3. Technological parameters were not influenced by the application of the bioproducts, but rather depended on the meteorological conditions of the year and were within the limits of the genetic determination of the variety.

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30- 15 15 1572,05 BGN/da, - 239,20%.

(Carvalho and Clemente, 2004).

2015 74 ha, 551 t 7446 kg/ha (Bulletin 308, MAF, 2016).

(Todorova, 2011).

(Mihov et al., 2001).

15 45 45 cm 1:2,35 (Saikia et al., 2010).

(Dintcheva, 2013).

(Borisov and Dincheva, 2014).

Kyustendil region is growing broccoli with sowing date 15 June and transplanting 30-day seedlings on 15 July. The net income is 1572,05 BGN/da and rate of rentability – 239,20%.

**Key words:** broccoli, yield, economic indicators

## INTRODUCTION

Broccoli is a vegetable with high economic value, a source of vitamins and substances with anticancerogenic properties (Carvalho and Clemente, 2004).

Broccoli production in the world is subject to the tendencies for healthy eating, but in Bulgaria it is limited and underrepresented. According to data from 2015, the occupied field areas with broccoli are only 74 ha, of which about 551 t have been produced at an average yield of 7446 kg/ha (Bulletin 308, MAF, 2016). The production of broccoli decreases due to the cultivation of other vegetable crops, traditional for the country (Todorova, 2011).

Late field broccoli production is economically efficient and culture can be grown as an alternative to traditional cabbage crops (Mihov et al., 2001).

A study on the economic effect of broccoli production in India at different sowing dates and planting schemes revealed that sowing on October 15 and planting a 45 x 45 cm is the most effective and the cost / benefit ratio is 1:2.35 (Saikia et al., 2010).

The economic assessment is the final stage of the overall technology in a given culture that forms the idea of production efficiency (Dintcheva, 2013).

Factors such as the scale and organization of production that determine the cost of production (Borisov and Dincheva, 2014) are influenced by the economic efficiency of production.

2008-2011 .  
 -  
 : Fiesta F<sub>1</sub>, Coronado F<sub>1</sub>, Marathon F<sub>1</sub>, Parthenon F<sub>1</sub>.  
 -  
 -  
 (1, 15 (30-  
 30 ), (30-  
 45- ) (1,  
 15 30 , 15 ).  
 -  
 4 , 20  
 , 7,2 m<sup>2</sup>/  
 80/50 cm.  
 ,  
 ( ).  
 .  
 :  
 (kg/da),  
 (BGN/da),  
 (BGN/da),  
 (BGN/kg), (BGN/da)  
 (%).  
 1,00 BGN/kg  
 - 0,50 BGN/kg.

- The purpose of this study is to perform a comparative economic assessment of some technological elements, including sowing and planting time and transplant age for late field broccoli production.

## MATERIAL AND METHODS

- The study was conducted in 2008-2011 at the Institute of Agriculture - Kyustendil with four broccoli hybrids: Fiesta F<sub>1</sub>, Coronado F<sub>1</sub>, Marathon F<sub>1</sub> and Parthenon F<sub>1</sub>. Plant genotypes were grown by late-field technology with variation in sowing dates (June 1<sup>st</sup>, 15<sup>th</sup> and 30<sup>th</sup>), transplant age (30- and 45-day) and planting time (1<sup>st</sup>, 15<sup>th</sup> and 30<sup>th</sup> July, and 15<sup>th</sup> August). The experiment is set as a multifactor field experience in 4 replications, with 20 plants in repeat, with a plot size of 7.2 m<sup>2</sup> on 80/50 cm planting scheme.

- Plant protection has been carried out against major diseases and pests, with treatments being performed on the basis of the Economic threshold (ET).

- Furrow irrigation was applied. The management of the irrigation regime and the forecasting of the irrigation were carried out by means of the visual assessment of the state of the plants.

- In order to perform an economic assessment, the indicators were analyzed: total average yield from central and lateral heads (kg/da), total output (BGN/da), production costs (BGN/da), cost price (BGN/da) and rate of rentability (%). The indices are calculated on the basis of a price for a central flower head of 1.00 BGN/kg and of the side flower heads – 0.50 BGN/kg.

## RESULTS AND DISCUSSION

- The results obtained from the production of broccoli grown at different

Fiesta F<sub>1</sub> -  
 3 ( 15  
 30- 15  
 ) – 2357,80 g/da.  
 1374,26 BGN/da ( 1).

sowing and planting periods enable an economic assessment of the technological elements of the four studied hybrids.

In the Fiesta F<sub>1</sub> hybrid, the highest productivity was recorded under variant 3 (growing by sowing on June 15<sup>th</sup> and planting a 30-day seedlings on July 15<sup>th</sup>) – 2357.80 kg/da. This option also features the highest yield of 1374.26 BGN/da (Table 1).

1.  
**Fiesta F<sub>1</sub> (2008-2011)**

**Table 1. Economic evaluation of variants of growing broccoli hybrid Fiesta F<sub>1</sub> (2008-2011)**

Variants	Total yield	Total production	Production costs	Cost price	Net income	Rentability
	g/da	BGN/da	BGN/da	BGN/ g	BGN/da	%
30- Variants of growing with 30-day transplants						
1/ 01.06. Variant 1/ date of sowing 1 June	2321,20	1920,90	632,44	0,27	1288,46	203,73
3/ 15.06. Variant 3/ date of sowing 15 June	2357,80	2010,15	635,89	0,27	1374,26	216,12
5/ 30.06. Variant 5/ date of sowing 30 June	1655,10	1450,70	544,73	0,33	905,97	166,31
45- Variants of growing with 45-day transplants						
2/ 01.06. Variant 2/ date of sowing 1 June	2253,70	1893,75	620,33	0,28	1273,42	205,28
4/ 15.06. Variant 4/ date of sowing 15 June	1773,60	1472,45	560,44	0,32	912,01	162,73

Fiesta F<sub>1</sub>,  
 0,27 BGN/kg  
 1 3,  
 2  
 0,28 /kg. -  
 (30 ) -

- An important criterion for the economic assessment of production is also the cost price of production, which is determined by the level of average yields and the amount of production costs. Of the tested Fiesta F<sub>1</sub> hybrids with low production cost of 0.27 BGN/kg, variants 1 and 3 are characterized, followed by variant 2 with a close value of 0.28 BGN/kg.

- The highest production cost price was obtained at late planting date (July 30<sup>th</sup>) –





2.

Marathon F<sub>1</sub> (2008-2011)

Table 2. Economic evaluation of variants of growing broccoli hybrid Marathon F<sub>1</sub> (2008-2011)

Variants	Total yield	Total production	Production costs	Cost price	Net income	Rentability
	g/da	BGN/da	BGN/da	BGN/ g	BGN/da	%
30- Variants of growing with 30-day transplants						
1/ Variant 1/ date of sowing 1 June	01.06. 2597,50	2202,20	662,17	0,25	1540,03	232,57
3/ Variant 3/ date of sowing 15 June	15.06. 2212,40	1953,70	614,13	0,28	1339,57	218,12
5/ Variant 5/ date of sowing 30 June	30.06. 2135,10	1892,55	602,20	0,28	1290,35	214,27
45- Variants of growing with 45-day transplants						
2/ Variant 2/ date of sowing 1 June	01.06. 2016,90	1736,60	589,49	0,29	1147,11	194,60
4/ Variant 4/ date of sowing 15 June	15.06. 2140,70	1846,60	603,21	0,28	1243,39	206,13

0,25 0,29 BGN/da, -  
1 , -  
- 2. -  
2, -  
- , -  
1147,11 BGN/da, -  
194,6 %. -  
Marathon F<sub>1</sub> 30-  
1  
1540,03 BGN/da, -  
232,57 %.  
Marathon F<sub>1</sub> 1  
- 30- 1  
-  
- 218,12 %.

The cost price is very close to each option and varies from 0.25 to 0.29 BGN/da, with the lowest cost being variant 1 and the highest - variant 2. It also links the data on net income and the rate of rentability. In variant 2, where the economic indicators are the weakest, a profit of 1147,11 BGN/da is realized and the rate of profitability is 194,6%.

Most economically, Marathon F<sub>1</sub> broccoli is produced by sowing the seeds on June 1 and planting 30-day transplants, with net income of 1540.03 BGN/da and a rentability rate of 232.57%.

Broccoli production from the Marathon F<sub>1</sub> hybrid is most economically advantageous during the sowing of June 1<sup>st</sup> and planting 30-day transplants on July 1<sup>st</sup>. Economic interest may also be production by sowing in the middle of June and planting in the middle of July, with a rate of rentability of 218.12%.

F<sub>1</sub> , - Coronado  
 2413,6 g/da,  
 2027,75 g/da ( 3).  
 2238,6 g/da  
 222,92 %.  
 - ,  
 - .

The assessment of the economic effect of the Coronado F<sub>1</sub> hybrid production shows that the highest yield is the early sowing and planting, with the total yield 2413.6 kg/da and the total output of 2027.75 kg/da (Table 3). The varietal response to the various technological options in terms of economic performance is clearly expressed. Relatively effective is the production of broccoli under variant 3 with a total yield of 2238.6 kg/da and a rate of rentability 222.92%. Most production costs are made in the most cost-effective variant, but this is due to labor costs for picking up the larger production.

### 3. Coronado F<sub>1</sub> (2008-2011)

**Table 3. Economic evaluation of variants of growing broccoli hybrid Coronado F<sub>1</sub> (2008-2011)**

Variants	Total yield	Total Production	Production costs	Cost price	Net income	Rentability
	g/da	BGN/da	BGN/da	BGN/ g	BGN/da	%
30-						
Variants of growing with 30-day transplants						
1/ 01.06. Variant 1/ date of sowing 1 June	2413,60	2027,75	640,44	0,27	1387,31	216,62
3/ 15.06. Variant 3/ date of sowing 15 June	2283,60	2020,55	625,72	0,27	1394,83	222,92
5/ 30.06. Variant 5/ date of sowing 30 June	2039,50	1788,80	592,23	0,29	1196,57	202,04
45-						
Variants of growing with 45-day transplants						
2/ 01.06. Variant 2/ date of sowing 1 June	2135,70	1907,55	604,21	0,28	1303,34	215,71
4/ 15.06. Variant 4/ date of sowing 15 June	1919,40	1677,20	575,12	0,30	1102,08	191,63

Parthenon F<sub>1</sub> , -  
 3277,0 g/da.  
 , -  
 , -

The information on indicators measuring the economic effect of growing variants at the Parthenon F<sub>1</sub> hybrid shows that the highest yield was obtained in variant 3 – 3277,0 kg/da. Both the appropriate climatic conditions during the growing season and the high productive qualities of the hybrid itself contribute to

( 4).

this. Logically, with this option, the most production costs are also invested (Table 4).

**4. Parthenon F<sub>1</sub> (2008-2011)**

**Table 4. Economic evaluation of variants of growing broccoli hybrid Parthenon F<sub>1</sub> (2008-2011)**

Variants	Total yield	Total Production	Production costs	Cost price	Net income	Rentability
	g/da	BGN/da	BGN/da	BGN/ g	BGN/da	%
30- Variants of growing with 30-day transplants						
1/ Variant 1/ date of sowing 1 June	01.06. 2725,80	2462,60	683,09	0,23	1779,51	260,51
3/ Variant 3/ date of sowing 15 June	15.06. 3277,00	2932,90	753,15	0,23	2179,75	289,42
5/ Variant 5/ date of sowing 30 June	30.06. 3047,50	2746,25	717,75	0,24	2028,50	282,62
45- Variants of growing with 45-day transplants						
2/ Variant 2/ date of sowing 1 June	01.06. 3141,50	2865,45	733,12	0,23	2132,33	290,86
4/ Variant 4/ date of sowing 15 June	15.06. 2836,50	2522,95	687,25	0,24	1835,70	267,11

Parthenon F<sub>1</sub>  
0,23-0,24 BGN/ g.

The cost price of production, determined by the average yields and the cost of production, is lowest for the Parthenon F<sub>1</sub> hybrid and is within the range of 0.23-0.24 BGN/kg. It is low because production costs are relatively the same as those for other hybrids, but average yields are significantly higher.

3 (2179,75 BGN/da).  
2 – 2132,33 /da,  
290,86 %.

Exploiting the opportunities for reduction the cost of production potential provides the basis for higher net income, especially for variant 3 (2179.75 BGN/da). Significant profitability is also achieved with variant 2 – 2132.33 BGN/da where the rate of rentability is the highest – 290.86%.

The results of the comparative economic assessment are entirely in

30-  
( 5).  
2532,65 g/da

606,50 BGN/da ( 4)  
657,22 BGN/da ( 3).  
BGN/da

657,22

( , , ).

15 15 favor of the sowing option of 15<sup>th</sup> June and the planting of 30-day transplants on 15<sup>th</sup> July (Table 5). The resulting total yield of 2532.65 kg/da directly affects the other economic indicators. The average annual production costs for these options range from 606.50 BGN/da (variant 4) to 657.22 BGN/da (variant 3). The input costs of 657.22 BGN/da do not increase the cost of production due to the high overall yield, which has the highest contribution to the resulting economic effect.

The analysis of the cost structure shows that the cost of labor costs is higher than that of inputs for all variants.

This difference is dependent on the different volume of activities carried out during the different years (plant protection measures, treatments, fertilization, irrigation and the resulting production).

## 5.

(2008-2011)

**Table 5. Economic evaluation in broccoli production (2008-2011)**

Variants	Total yield	Total Production	Production costs	Cost price	Net income	Rentability
	g/da	BGN/da	BGN/da	BGN/ g	BGN/da	%
30- Variants of growing with 30-day transplants						
1/ 01.06. Variant 1/ date of sowing 1 June	2514,50	2153,35	654,53	0,26	1498,82	228,99
3/ 15.06. Variant 3/ date of sowing 15 June	2532,65	2229,28	657,22	0,26	1572,05	239,20
5/ 30.06. 5/ date of sowing 30 June	2219,40	1969,65	614,23	0,28	1355,42	220,67
45- Variants of growing with 45-day transplants						
2/ 01.06. Variant 2/ date of sowing 1 June	2386,90	2100,80	636,78	0,27	1464,02	229,91
4/ 15.06. Variant 4/ date of sowing 15 June	2167,60	1879,85	606,50	0,28	1273,35	209,95

30-  
15 ( 1).

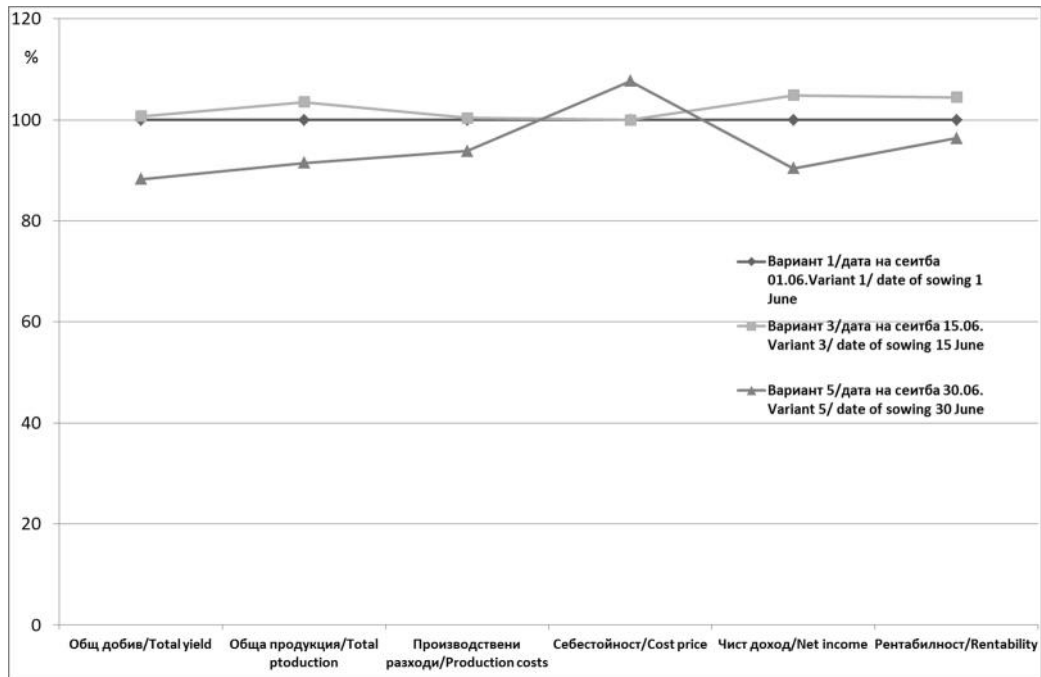
When comparing the variants with 30-day transplants with the highest contribution to the economic effect obtained, it is possible to choose a variant with date of sowing 15<sup>th</sup> June

100,7%,

( -

88,3%

(Figure 1). The average yield is 100.7% compared to the one selected for control (earliest date of sowing, the yield level is minimized at the latest sowing date – 88.3% of the control version).



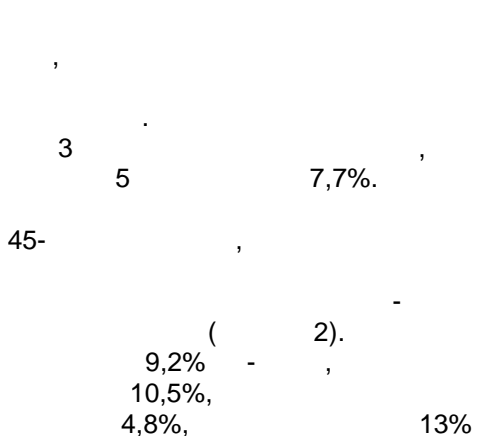
\* Benchmark is variant with earliest date of sowing (variant 1 = 100%)

\* Benchmark is variant with earliest date of sowing (variant 1 = 100%)

. 1.

30-

**Fig. 1. Amendment of economic indicators on variants of growing with 30-day transplants**



The variation in total output, net income and rentability follow the same trend. The cost of variant 3 equals the control, and in variant 5 it increased by 7.7%.

For variants grown with 45-day transplants, the results of the change in the main economic indicators are in favor of the earlier sowing date (Figure 2).

The resulting yield was 9.2% higher, total production by 10.5%, production costs by 4.8%, net income by 13% and the rate of

01 .

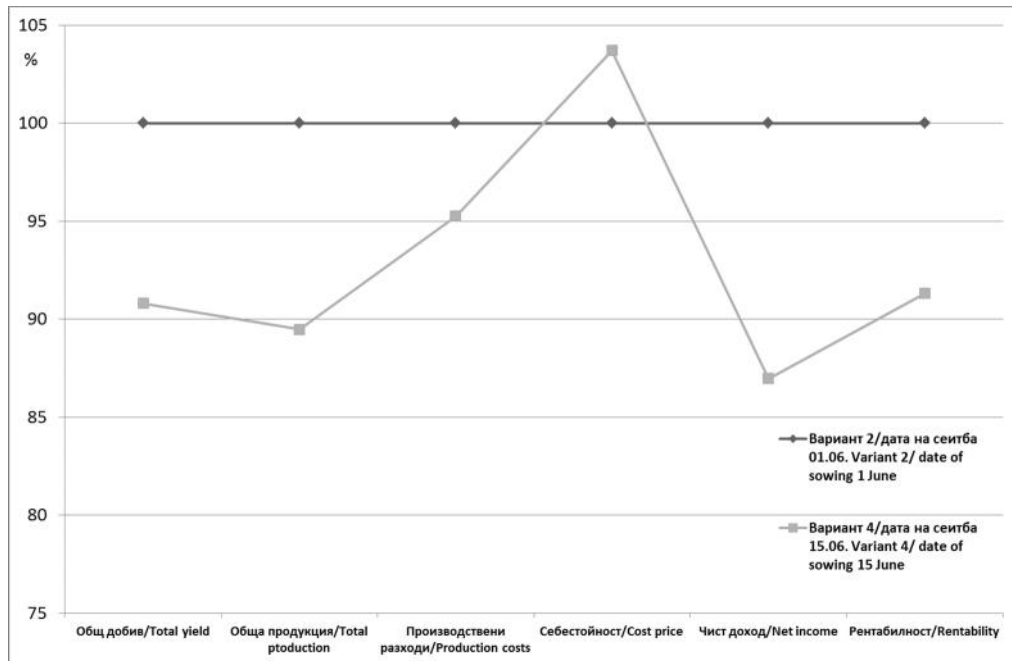
30-15 ,

3,7% .

45-

rentability by 8.7%. The cost price of production is reduced by 3.7%.

It was found that when using 30-day transplants, sowing on June 15<sup>th</sup> has a higher economic effect, and when using 45-day transplants it is advisable to sow on June 1<sup>st</sup>.



\* Benchmark is variant with earliest date of sowing (variant 2 = 100%) ( 2 = 100%)

\* . 2.

45-

**Fig. 2. Amendment of economic indicators on variants of growing with 45-day transplants**

-

15

15 .

1572,05 BGN/da,

- 239,20%.

30-

From an economic point of view, the broccoli growing in the Kyustendil region is most effective with sowing on June 15<sup>th</sup> and planting 30-day transplants on July 15<sup>th</sup>. The net income is 1572,05 BGN/da and the rate of rentability is 239,20%.

**CONCLUSIONS**

1.

- 1. The yield obtained in the different variants directly affects the economic effect of the production of the studied



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## NASA - SL

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2, 3,  
3, 3,  
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### Testing of cytotoxic- genotoxic effect of total herbicide NASA - SL, in onion root

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Samir Mulaku<sup>3</sup>

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University of Prishtina, Kosovo

#### SUMMARY

NASA-SL  
NASA-SL  
a  
(5, 10, 15 20, 30 ml  
)  
8-  
NASA – SL,

Main objective of this investigation was testing the cytotoxic – genotoxic effect of total herbicide NASA-SL, in onion root, through the length of root of onion.  
Herbicide NASA–SL, is total herbicide, active substances contain: Glyphosate.  
Five doses, (5, 10, 15, 20, 30 ml herbicide) were assessed for cytotoxic after 8 day exposure. Cytotoxicity of treated onion roots was inferred through the length of root of onion.  
According to the obtained results we can conclude that herbicide NASA–SL, has cytotoxic – genotoxic effect in onion roots. By increasing the concentration of Glyphosate the length of

30 ml  
 9.2 cm 8  
 :  
 NASA-  
 SL,

root of onion it was shorter. At concentration of 30 ml herbicide the length it was zero. While at control group the length of onion root it was till 9.2 cm for 8 days.

**Key words:** cytotoxic-genotoxic effect, herbicide NASA-SL, onion, root

**INTRODUCTION**

Genotoxicity is one of the serious side effects of pesticides exposure. The environmental pollution has increased tremendously over the last few decades due to the various human activities. Agrochemicals necessary for efficient crop production are significant pollution source.

((Dimitrov et al., 2006; Mustafa and Arikan, 2008; Yuzbasioglu et al., 2009; Lamsal et al., 2010).

The pesticides possess biological activity including genotoxic influence (Dimitrov et al., 2006; Mustafa and Arikan, 2008; Yuzbasioglu et al., 2009; Lamsal et al., 2010). So, pesticides with mutagenic potential can influence non target organisms and adversely affect human health (Bolognesi, 2003).

(Bolognesi, 2003).

Pesticides used for modern farming represent a substantial input of toxic substances in the environment, and residues present in fruits and vegetables are important risk factors for consumers.

Pollution is a major problem which lowers the quality of life in various aspects. A pollutant is any substance that may present in the nature in quantities greater than natural abundance, chiefly due to human activities and ultimately harm the environment along with its living system (Khopkar 2002).

(Khopkar 2002).

Environmental pollutions may be mutagenic or toxic to all living organisms. Use and constant exposure to these chemicals may result in change in the genetic constitution of an organism. Mutagenic activities at cellular level can be induced by air pollutants, water

et al., 1994).

*Allium cepa* ( )

*cepa*

(Panday

*Allium*

pollutants, food additives, drugs, beverages, pesticides and industrial products. Many genotoxic studies have been carried out to detect the harmful effects of different pesticides which reveal their hazardous effects in addition to benefits. Their undesirable residues in water, food, and environment may cause some serious health problems. Chromosomal abnormalities induced by some of these compounds were found to be linked with their capacity to induce mutations (Panday et al., 1994).

*Allium cepa* (onion) has been considered as a most efficient test organism to indicate the presence of mutagenic chemicals due to its kinetic characteristics of proliferation and possession of chromosomes suitable for cytotoxic study.

Different parameters of *Allium cepa* such as root shape, growth, mitotic index, chromosomal aberrations etc can be used to estimate the cytotoxicity and mutagenicity of environmental pollutants.

## MATERIAL AND METHODS

**Compound tested:** NASA-SL,

**Active ingredient is:** Glyphosate

Dose selection experiment was conducted with different concentrations of herbicide below the manufacturers recommended dose of 5,10,15,20 and 30 ml/L.

Commercially available bulbs of onion (*Allium cepa* L.) were utilized for the study. Acetocarmine squash preparation was used for mitotic studies. Four slides were prepared for each treatment.

The cytotoxic effect is followed by the length of root of onion.

The genotoxic effect is followed by the micronucleus in the cells of the root of onion and in cells of the bulb.

The herbicide NASA-SL, before using is diluted to five different concentrations: 5, 10, 15, 20 and 30 ml,

: NASA-SL,

5,10,15,20 30

ml/L.

(*Allium cepa* L.)

NASA-SL,

: 5, 10, 15, 20 30 ml

20

1.

NASA-SL.

NASA-SL

30 ml ( / l ) 1).

( 1).

5 ml /

5 ml

/ 1 L 1.353 mm.

10 ml /

5 ml

10 ml / 1 L

1.225 mm.

15 ml /

5 ml 10

ml

15 ml / 1 L

0.425 mm.

20 ml /

5, 10 15 ml

ml / 1 L 0.275 mm.

8 | per liter. At each concentration treated 20 onion bulbs. The onions are treated for 8 days.

**RESULTS AND DISCUSSION**

The results are presented at Table 1. As it shows in table the length of onion roots are decrease by increasing the concentration of Glyphosate NASA-SL.

The degree of toxicity of herbicide NASA-SL to onion roots was assessed by means of the root length values (Table 1). The dose of 30 ml herbicide / l water blocked growth of cells of root of onion (Figure 1).

The dose of 5 ml herbicide / per liter water caused negative effect – inhibition of root elongation, compared with the root of control group of onions. The average length of onion root at concentration of 5 ml herbicide/ 1 L, is 1.353 mm.

At dose of 10 ml herbicide / per liter water caused more negative effect – the length of onion root is became shorter, compared with the root of onions treated at concentration of 5 ml and with control group of onions. The average length of onion root at concentration of 10 ml herbicide/ 1 L, is 1.225 mm.

At dose of 15 ml herbicide / per liter water caused more negative effect – the length of onion root is became shorter, compared with the root of onions treated at concentration of 5 and 10 ml and with control group of onions. The average length of onion root at concentration of 15 ml herbicide/ 1 L, is 0.425 mm.

At dose of 20 ml herbicide / per liter water caused more negative effect – the length of onion root is became shorter, compared with the root of onions treated at concentration of 5, 10 and 15 ml and with control group of onions. The average length of onion root at concentration of 20 ml herbicide/ 1 L, is 0.275 mm.

5.59 cm.

The average length of onion root at control group of onions is 5.59 cm.

1.

**NASA - SL, 1**

**Table 1. Results of length of root of onion, in different concentration of herbicide NASA - SL, diluted in 1 liter**

Length of root of onion, in different concentration of herbicide, diluted in 1 liter						
	5ml/1L	10ml/1L	15ml/1L	20ml/1L	30ml/1L	Control
1	1mm	1.5mm	0mm	0.5mm	0	3.5cm
2	1mm	0mm	0mm	0.5mm	0	4.7cm
3	2mm	1.5mm	0.5mm	1 mm	0	1.5 cm
4	0mm	0mm	0mm	0.5mm	0	6.5cm
5	1.5mm	0mm	0mm	0 mm	0	3.4cm
6	0mm	2 mm	0mm	0.5 mm	0	1 cm
7	0mm	3mm	1mm	0 mm	0	8.7cm
8	0.5mm	2mm	0.5mm	0 mm	0	7.8cm
9	1mm	0mm	0.5mm	0.5 mm	0	3.8cm
10	4mm	2 mm	0mm	0 mm	0	7.5cm
11	1.5mm	0.5mm	0mm	0 mm	0	1.4cm
12	0mm	0.5mm	1 mm	0 mm	0	9.2cm
13	2mm	2 mm	0mm	0 mm	0	5.1cm
14	4mm	0.5mm	1.5mm	0 mm	0	8.5cm
15	1.5mm	2 mm	0.5mm	0.5 mm	0	4.1cm
16	3mm	0mm	0.5 mm	1 mm	0	7.5cm
17	3mm	1mm	1mm	0 mm	0	6.2cm
18	0mm	0mm	0mm	0.5 mm	0	8.3cm
19	1mm	3 mm	1mm	0 mm	0	7.1cm
20	0.5mm	3 mm	0.5mm	0 mm	0	6cm

Average Length of onion root

27.05 mm : 20 = 1.353 mm	24.5 : 20= 1.225 mm	8.5 : 20= 0.425 mm	5.5 mm : 20= 0.275 mm	0 mm	111.8 cm : 20= 5.59 cm
-----------------------------	------------------------	-----------------------	--------------------------	------	---------------------------

2 ( ) 500

At Table 2 are presented the number of micronucleus (MN) at 500 cells of root and bulb of onion, in different concentration of herbicide.

(11 M / 500 ) -  
(5 MN / 500 ).  
15 20 ml

As it show in table the average number of micronucleus in cells of onion root (11 MN / 500 cells) is higher compared with cells in onion bulb (5 MN / 500 cells). At concentration of 15 and 20 ml herbicide the difference of number of micronucleus in cells of onion root it was 2 MN, while in cells of onion bulb is 1 MN.

2 M ,  
1 M .

M - -

At control group the number of MN is lower compared with treated onions with herbicide.

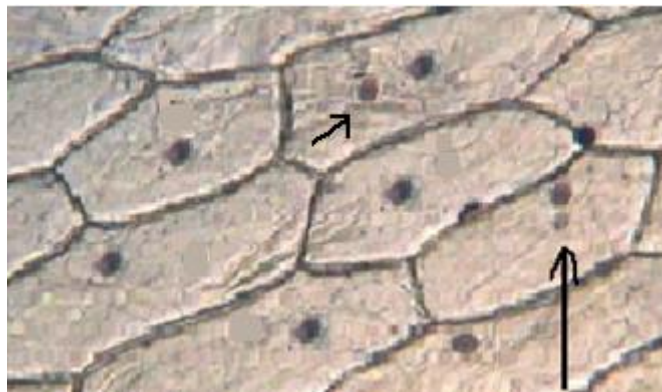
**Table 2. Number of micronucleus (MN) at 500 cells of root and bulb of onion, in different concentration of herbicide**

Number of MN /500 cells	Number of micronucleus(MN) at root and bulb of onion , in different concentration of herbicide					
	5ml/1L	10ml/1L	15ml/1L	20ml/1L	30ml/1L	Control
In onion root	11	14	15	17	0	4
n onion bulb	5	8	10	11	0	2



. 1.

**Fig. 1. Micronucleus in cells of onion root**



. 2.

**Fig. 2. Micronucleus in cells of onion bulb**

**CONCLUSIONS**

Based on obtained results can conclude that herbicide nasa sl has cytotoxic and genotoxic effect in cells of

nasa sl

root and bulb of onion, compared with control group.

- The length of roots at control group
- was a manifold longer than the root of the treated onions.
- The number of micronucleus at treated onions it was higher compared with control group.

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2010

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\*E-mail: ramadani.ibrahim@yahoo.com

## Algocenosis in uperstream of river Vardar during spring season of 2010 year

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### SUMMARY

The main objective of this study was to investigate the algocenosis in uperstream part of river Vardar (Macedonia) during spring season of 2010 year. The samples were taken at three localities. The conservation is done by formaldehyde 4 %. The determination is done by algal keys.

During the investigation period we noticed 56 species of algae, which belong to 4 divisions: *Cyanophyta* (8 species), *Bacillariophyta* (30 species), *Euglenophyta* (6 species) and *Chlorophyta* (12 species). The algocenosis is dominate by *Bacillariophyta* (30 species or 53,57 %),

( )  
2010 .

56 ,  
4 :  
*Cyanophyta* (8 ), *Bacillariophyta* (30 )  
, *Euglenophyta* (6 )  
*Chlorophyta* (12 ).  
*Bacillariophyta* (30



53.57 %),  
21.43%, *Cyanophyta*  
*Euglenophyta* 10.71%.

*Chlorophyta*  
14.29%

followed by *Chlorophyta* with 21.43 %, *Cyanophyta* with 14.29 % and *Euglenophyta* with 10.71 %.

We analysed and physico-chemical parameters, such as : temperature, TDS, pH, salts.

**Key words:** Algae, river, Vardar, Macedonia

## INTRODUCTION

- Analysis of algocenosis of the
- phytoplankton and phytoplankton of river Vardar, which flowing over the west part of territory of the Macedonia and subject to anthropogenic load resulting from urbanization is presented. The effect of changes in the hydrological and hydrochemical regimes on the species composition and biomass of phytoplankton and phytoplankton algae is discussed. The possibility of using phytoplankton and phytoplankton as an indicator of the ecological state of the river ecosystems is analyzed. Organic pollution occurs when large quantities of organic compounds from many sources are released into the receiving running waters, lakes and also seas. Organic pollutants originate from domestic sewage (raw or treated), or urban runoff, industrial effluents and farm water.
- Organic effluents also frequently contain large quantities of suspended solid which reduce the light available to photosynthetic organisms mainly algae.

In addition organic wastes from people and animals may also rich in disease causing (pathogenic) organisms (Altenburger et al., 2000).

## MATERIAL AND METHODS

The samples were collected from 3 sampling sites, along the river Vardar during spring season of 2010 year.

Water samples were collected in 500 ml glass bottles, 10 cm beneath the

(Hindák, 1978).	water surface, using standard methods (Hindák, 1978).
, pH,	Conductivity, pH, salts, TDS (Total
( )	Dissolved Salts), were measured on site
(HACH).	using portable instruments (HACH). Epilithon was brushed from the stones using a toothbrush. Epiphyton was sampled from the substrate and placed in the plastic bottles.
.	The diatoms were examined using a Leica microscope.
Leica.	
	<b>Diatoms cleaning</b>
	Cleaning of diatoms' frustules and the preparation of slides and their determination was done according to Krammer and Lange-Bertalot (1986, 1988, 1991a, 1991b).
Krammer Lange-Bertalot (1986, 1988, 1991a, 1991b).	Diatoms' identification was done according to the keys: <i>Bacillariophyta</i> : Kramer and Lange-Bertalot (1986, 1988, 1991a, 1991b).
<i>Bacillariophyta</i> : Kramer Lange-Bertalot (1986, 1988, 1991a, 1991b).	Identification of Cyanophyta was done according to the key: Anagnostidis, 1988
Cyanophyta	Identification of Chlorophyta and Euglenophyta was done according to the key: Ettl (1960).
: Anagnostidis, 1988.	
Chlorophyta	
Euglenophyta	
Ettl (1960).	
	<b>Study area</b>
	The River Vardar rises at Vrutok, a few kilometers north of Gostivar in the Republic of Macedonia. It passes through Gostivar, Skopje and into Veles, crosses the Greek border near Gevgelija, Polykastro and Axioupoli ("town on the Axiós").
	Geographical coordinates of river Vardar, in degrees minutes seconds: Latitude 40°30'27 N, Longitude 22°43'3 E.
40°30'27 N,	
22°43'3 E.	



Vardar River



Vardar River – Macedonia

## RESULTS AND DISCUSSION

During the investigation period we noticed 56 species of algae, which belongs 4 division: *Cyanophyta* (8 species), *Bacillariophyta* (30 species), *Euglenophyta* (6 species) and *Chlorophyta* (12 species). The algocenosis is dominated by *Bacillariophyta* (30 species or 53,57 %), followed by *Chlorophyta* with 21.43 %, *Cyanophyta* with 14.29 % and *Euglenophyta* with 10.71 %.

The results of our investigation are presented in Table 1. Determined species (56 species) belongs to 4 divisions: *Bacillariophyta* (30 species or 53,57 %), followed by *Chlorophyta* with 21.43 %, *Cyanophyta* with 14.29 % and *Euglenophyta* with 10.71 %.

The division *Bacillariophyta* contain 20 genus, followed by *Cyanophyta* with 6 genus, *Euglenophyta* and *Chlorophyta* by 3 genus .

The number of species per locality is different : in first locality determined 17 species, in second determined 31 , while at third locality is determined 29 species. As seen second and third locality has more number of algal species than second locality.

56 species, belonging to 4 divisions: *Cyanophyta* (8 species), *Bacillariophyta* (30 species), *Euglenophyta* (6 species) and *Chlorophyta* (12 species). *Bacillariophyta* (30 species or 53.57 %), *Chlorophyta* (21.43%), *Cyanophyta* (14.29%) and *Euglenophyta* (10.71%).

56 species, belonging to 4 divisions: *Bacillariophyta* (30 species or 53.57 %), *Chlorophyta* (21.43%), *Cyanophyta* (14.29%) and *Euglenophyta* (10.71%).

20 genus, followed by *Cyanophyta* (6 genus), *Euglenophyta* and *Chlorophyta* (3 genus).

The number of species per locality is different: in the first locality determined 17 species, in the second determined 31, while in the third locality determined 29 species. As seen, the second and third localities have a greater number of algal species than the second locality.

1.

2010 .

## 1. Determined algae in waters of river Vardar during spring season of 2010

		Level of saprobity	Localities		
			1	2	3
	<b>/ Divison Cyanophyta</b>				
1	Anabaena inequalis (Born. et Fla.)		+		
2	Chroococcus cochaerens (Naeg.)			+	
3	Nostoc linckia (Born et Flah.)				+
4	Oscillatoria .formosa (Bory)		+	+	
5	Oscillatoria mirabilis (Böcher)				+
6	Phormidium ambigum (Gom.)			+	+
7	Ph. molle (Kützing)	-		+	
8	Spirulina platensis (Nordst.)Geitl.		+		+
	<b>Number of bioindicators species per locality</b>	4	3	4	4
8	<b>Cyanophyta</b>				
	<b>/Total number of species</b>				
	<b>Cyanophyta and number of species per locality</b>				
30	/species				
	<b>/ Division BACILLARIOPHYTA</b>				
1	<b>Achnantes</b> hungarica(Gunow)	o		+	
2	<b>Amphora</b> lybica (Ehrenberg)		+	+	
3	Amphora normani (Rabenhorst)	o			+
4	<b>Cocconeis</b> pediculus (Ehrenberg)	-		+	+
5	Cocconeis placentula (Ehrenberg)			+	
6	<b>Centronella</b> reichelti(Voigt)		+	+	
7	<b>Cyclotella</b> ocellata (Pantoseck)				+
8	<b>Cymatopleura</b> solea (Brebisson) W.Smith	-		+	+
9	<b>Cymbella</b> affinis (Kützing)	-	+		
10	C.helvetica (Kützing)			+	
11	C.naviculiformis (Auerswald) Cleve		+	+	
12	<b>Diatoma</b> ehrenbergi Kützing				+
13	D.monoliforme (Kützing)			+	+
14	D.vulgaris (Bory)			+	
15	<b>Epithemia</b> adnata (Kützing)				+
16	<b>Fragilaria</b> ulna (Nitzh.) Lange-Bertalot		+		
17	<b>Gomphonema</b> parvaulum (Grunow)		+		
18	<b>Gyrosigma</b> acuminatum( Kützing)			+	
19	<b>Melosira</b> varians (Agardh)		+	+	+
20	<b>Meridion</b> circulare (Agardh)		+	+	
21	<b>Navicula</b> lanceolata (Agardh) Ehrenberg				+
22	Navicula radiosa (Kützing)	-		+	+
23	Navicula tripunctata (O.F.Müller) Bory				+
24	<b>Nitzschia</b> dissipata (Kützing) Grunow	-			+
25	<b>Nitzschia</b> palea (Kützing) W.Smith			+	
26	<b>Pinnularia</b> microstauron (Ehren.)Cleve			+	
27	<b>Rhoicosphenia</b> abbreviata (Kützing)Grun		+	+	
28	<b>Surirella</b> angusta Kützing)				+
29	<b>Synedra</b> ulna (Nitzsch) Ehrenberg.		+	+	+
30	S.nana (Meister)			+	+
	<b>/Number of bioindicators species per locality</b>	17	10	19	15
30	<b>Bacillariophyta</b>				
/species	<b>/Total number of species</b>				
	<b>Bacillariophyta and number of species per locality</b>				

6	/species	<b>/ Division EUGLENOPHYTA</b>				
1		<i>Euglena viridis</i> (Ehrenbeg)	-			+
2		<i>E.terricola</i> (Dang.) Lemm				+
3		<i>E.oblonga</i> (Schmitz.)			+	+
4		<i>E. intermedia</i> (Klebs) Schmitz.	0-		+	
5		<i>Phacus hispidulus</i> Lemm.		+		
6		<i>Trachelomonas.affinis</i> Lemm.				+
		<b>Number of bioindicators species per locality</b>	2	1	2	4
6	/species	<b>Euglenophyta</b> <b>/ Total number of species</b> <b>Euglenophyta and number of species per locality</b>				
12	/species	<b>/ Division CHLOROPHYTA</b>				
1		<i>Cladophora fract a</i> (Roth) Kütz			+	
2		<i>C.fracta var. lacustris</i> (Roth) Kütz				+
3		<i>C glomerata</i> (L) (Kütz)		+		+
4		<i>Closterium archerianum</i> Cleve		+	+	
5		<i>C attenuatum</i> Ehreb.				+
6		<i>C.gracilis</i> (Breb.)			+	+
7		<i>C. moniliferum</i> Nitzsch			+	
8		<i>C.parvulum</i> Naegeli		+		
9		<i>C.praelongum</i> (Breb.)				+
10		<i>C.striolatum</i> Ehreb			+	
11		<i>C. venus</i> Kütz			+	
12		<i>Stigeoclonium tenue</i> Kützing				+
		<b>Number of bioindicators species per locality</b>	6	3	6	6
12	/species	<b>Chlorophyta</b> <b>/ Total number of species</b> <b>Chlorophyta and number of species per locality</b>				
56	/species	<b>/ Total number</b> <b>of species of algae and bioindicators species</b> <b>during spring season per locality</b>	29	17	31	29

*Cyanophyta*

- Chlorophyta algae in the studied period were in subdominant community, they were registered in all studied parts of the river. Diversity and productivity of algae vary from one rock type to another depending on the nature of the physical and chemical properties of the rock.

- Large stones are expected to have stable communities, whilst small ones may be so moved during periods of high flow that the flora diversity and richness is reduced (Marker and Willoughby, 1988).

- Lobo et al. (2004) described *Nitzschia palea* as partially pollution tolerant. In this study, however, this species had high relative abundance in

(Marker and Willoughby, 1988).  
Lobo et al. (2004) *Nitzschia palea*

*N. palea* G. *parvulum* ( Lange-Bertalot, 1979; Kobayasi and Mayama, 1989; Tapia, 2008).

eutrophic sites. Many studies describe *N. palea* and *G. parvulum* as cosmopolitan, high pollution tolerant species, especially eutrophication and organic pollution (e.g. Lange-Bertalot, 1979; Kobayasi and Mayama, 1982; Tapia, 2008).

The values of physical and chemical parameters (temperature, conductivity, TDS, salinity, pH) measured in the study area during the spring season are presented in Table 2.

Temperature, conductivity, TDS, salinity and pH, increase downstream of river.

The water quality generally deteriorate downstream of the river passed through the urban area due to discharge of untreated domestic and industrial effluent, as well as other diffuse sources of pollution from the different settlements.

2.

2010

**Table 2. Physicochemical parameters of the water of river Vardar during spring season of 2010**

Physicochemical parameters	/ Locality		
	1	2	3
/ Temperature, °C	12.2	12.7	13.3
. / TDS, mg/l	345	419	498
/ Conductivity, µS/cm	231	365	485
pH	6.32	6.55	7.16

**CONCLUSIONS**

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During the study period (spring season 2010) we identified 56 species of algae.

30

*Bacillariophyta*

Dominated the *Bacillariophyta* by 30 species, compared with other divisions.

29

Determined 29 bioindicators species, dominated beta mesosaprob

15

bioindicators species by 15 species.

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