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CONTRIBUTION TO THE SCIENTIFIC FUNDAMENTATION OF DIVERSIFYING THE BIOLOGICAL FUND WITHIN SPECIES WITH SANOGENIC PROPERTIES *Ribes nigrum* AND *Ribes Rubrum*

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Abstract

In the context of development the concept with regard to the role of diversification the plant species with sanogenic properties about increasing the quality of life, they were initiated at the University of Agricultural Sciences and Veterinary Medicine Bucharest, Romania, researches on diversity of biological fund at the species Ribes nigrum and Ribes rubrum.
This paper emphasize in synthesis, the results of the research developed during 2010 - 2012, with regard to the particularities of biological, agronomic and adaptability characteristics of varieties Roxia, Kzvana, Deea, Elita 124, Tinker, Triton, Abanos, Tenah of the Ribes nigrum species and Tatran, Elite, Rolan, Detwar, Jonkheer van Tets of the Ribes rubrum species.
The plants of the varieties studied are in the juvenile period, the main characteristic being the alert rhythm of growth and the balance between growth and development. Under this aspect, were detached the varieties Roxia, Elita 124, Kzvana, Deea of the Ribes nigrum species and Jonkheer van Tets, Rolan, Detwar of the Ribes rubrum species.
In terms of productivity have been remarked the varieties Deea, Roxia, Kzvana of the Ribes nigrum species and Rolan and Jonkheer van Tets of the Ribes rubrum species.

Key words: *evolution,milk production, NW Region, Romania, trends.*

INTRODUCTION

Biodiversity, as a concept, was introduced by biologists for the first time in the middle of the 1980's. After this concept was elaborated, the diversity of living systems started to be studied intensively, with regard to the diversity of the species belonging to the plant and animal world and some intrinsic properties of the studied ecosystems and communities were identified. (Vasilevich, 2009). In this context, lately, the scientific interest has raised towards the plant species with health promoting properties, the genus *Ribes* being one of them. During the recent years the scientific interest has raised towards the species belonging to this genus and also towards the varieties of these species. This happened, due to the taste of the fruit as well as the health benefits generated by their consumption. To these benefits, there can be added the possibility of therapeutically exploiting the plant components (Oprea, 2008; Liobicas, 2008; Ikuta, 2012; Mitchell et al., 2011).

The blackcurrant (*Ribes nigrum* L.) represents a very important culture in Poland, Central Europe and Northern Europe as well as in all the slightly temperate areas of the world. The most important attributes that show phenotypic diversity between the varieties of currants are: the size and the development stage of the fruit, the number of shots, the fruiting yield and the susceptibility of pests and diseases (Madry, 2010). Therefore, the varieties of *Ribes nigrum* and *Ribes rubrum* species are cultivated or their economically importance on one hand, and on the other hand for their health promoting and nutraceutical properties (M.E.Arena, 2008) which makes that the interest towards the spread of their cultivation to growth all over the world, including United States of America (Hummer and Dale, 2010).
The aim of this study is to make a contribution to the biological fund diversity within species *Ribes nigrum* and *Ribes rubrum*, by identifying superior varieties in terms of growth and development characteristics, fructification and

productivity as an indicator of their adaptability to the study area.

MATERIALS AND METHODS

The research has been conducted in the orchard of the Experimental Teaching Field, University of Agronomic Sciences and Veterinary Medicine of Bucharest, as well as the experimental field of Faculty of Agriculture, part of the specialization Biology. The experiments were done during the year 2012, on a currants plantation which includes the species *Ribes nigrum* and *Ribes rubrum* with the following varieties: Deea, Roxia, Elita 124, Abanos, Triton, Tenah, Kzvana, Tinker and Rolan, Jonkheer van Tets, Detwar, Tatran, Elite.

The collected data from the field and laboratory were summarized and statistically analyzed applying Student's t test considering the average values of the characteristics of each variety analyzed. For each characteristic analyzed were calculated standard deviation of the arithmetic mean, coefficient of variation and the t value.

RESULTS AND DISCUSSIONS

The growth of the length of shoots during the annual cycle, represents growth and development characteristic for *Ribesnigrum* and *Ribes rubrum* varieties which can aide in determining the growth rhythm of the plants.

Based on the measurements, determinations and statistical analysis a few observations have been emphasized the following: the growth limits, the variability of the characteristics expressed by the variability coefficient and the significance of the growth differences varieties and species.

The determinations in the length of shoots during the intensive growth period April – May, showed a big variability of this characteristic for the varieties of *Ribes nigrum* as well as for the varieties of *Ribes rubrum*. For the varieties of *Ribes nigrum*, the variability coefficient S% had values between 26.96 and 46.96 (Table 1). With regard to the variability in the length of the shoots, the varieties Abanos and Elita 124 showed the best results, with the limits for their groups 3.60 – 84.5 and 12.50 – 82.00 cm, respectively.

Table 1. The length of shoots variation of *Ribes nigrum* varieties

Length of shoots of blackcurrant varieties in the third year after planting				
No. crt.	Variety	Class limits (cm)	Centers of class (cm)	S%
1	Kzvana	14.5-77.5	19-73.00	35.9
2	Deea	14.00-68.00	17.56-64.14	35.6
3	Roxia	14.50-73	18.68-68.82	26.96
4	Elita 124	12.50-82.00	17.46-77.04	43.08
5	Abanos	3.60-84.5	9.38-78.72	46.96
6	Triton	12.60-53.70	15.54-50.76	38.33
7	Tenach	17.30-43.50	19.17-41.63	29.27
8	Tinker	2.00-46.70	5.19-43.51	39.94

Following the same example, the determinations for the length of shoots during the intensive growth period for the varieties of the *Ribes rubrum* species showed a high variability, S% coefficient having values between 27.01 and 76.6 cm (Table 2).

Table 2. The length of shoots variation of *Ribes nigrum* varieties

Length of shoots of redcurrant varieties in the third year after planting				
No. crt	Variety	Class limits (cm)	Centers of class (cm)	S%
1	Elite	1.00-59.00	5.14-54.86	76.6
2	Rolan	12.20-34.50	13.79-32.91	42.65
3	J van Tets	2.70-40.60	5.41-37.89	27.1
4	Tatran	4.70-38.80	7.14-36.36	33.27
5	Detwar	13.70-41.80	15.71-39.79	25.04

Amongst the species *Ribes rubrum* the best varieties were Elite and Detwar with class limits between 1.00 – 59.00 cm and 13.70 – 41.80 cm, respectively.

Third year after planting, 50% of the varieties in the *Ribes nigrum* species can be found distributed between the class limits of variation of the length of shoots with values between 33.35 and 35.21 cm (Figure 1). With regard to this aspect, the varieties Abanos, Elita 124, Roxia and Kzvana showed the highest levels.

A 40% of the varieties of the *Ribes rubrum* species can be found between the class limits of variation for the length of the shoots with maximum values between 20.66 and 21.09 cm (Figure 2). According to this aspect, the varieties Rolan and Jonkheer van Tets showed the highest levels.

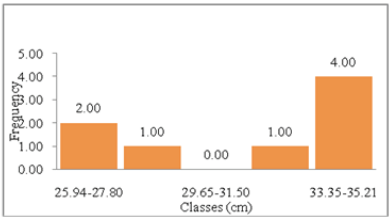

Figure 1. Length histogram varieties of *Ribes nigrum* shoots

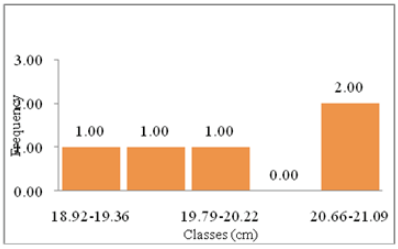

Figure 2. Length histogram varieties of *Ribes rubrum* shoots

The highest value for the growth of the shoots was identified for the *Ribes rubrum* variety, Elite with 59 cm, nonetheless, the Abanos variety showed superior values (84.5 cm) belonging to the *Ribes nigrum* species, being with almost 50% bigger than the Elite variety.

With regard to the aspect of the significance of the differences of the means for the growth of the shoots for *Ribes nigrum* species, the t value was compared with the t values for the 3 transgression probabilities. Therefore, there could be shown that the determined t value for the Tinker variety is higher than each one of the other t values which means that the difference is very significant (Table 3).

Regarding to the aspect of the significance of the differences between the means of the growth of the shoots for the Ribes rubrum species, the difference between the means length of the shoots was insignificant (Table 4).

With regard to the production characteristics of the currants during June -July 2012, the following characteristics have been analyzed: the weight of bunches, berries and raceme. Also, the production per shrub and per hectare. Therefore, the determination for the weight of bunches showed a very high variability for the both species. The variability coefficient S% had values between 46.88 and 54.41 for the varieties of the *Ribes nigrum* species (Table 5).

According to that, the aspect of the variability of the weight of the bunches, the best varieties were Deea and Roxia with their class limits between 1.03 – 15.87 g and 1.42 – 13.14 g, respectively.

Table 3. The significance of differences between the growth means of shoots of *Ribes nigrum* varieties

Variety	t calculated	Degrees of freedom	t 5%	t 1%	t 0.5%	Significance*
Kzvana	-1.42	33.02	2.035	2.733	3.008	○○○
Deea	1.01	30.62	2.04	2.744	3.022	xx
Roxia	-1.04	32.78	2.035	2.733	3.008	○○○
Elita 124	-1.40	33.40	2.032	2.728	3.002	○○○
Abanos	-1.23	33.04	2.035	2.733	3.008	○○○
Triton	2.11	29.42	2.042	2.75	3.03	xx
Tenach	-0.49	32.12	2.037	2.738	3.015	○
Tinker	2.68	28.89	2.045	2.756	3.038	xxx

High significant - xxx, significant - xx, insignificant – x (positive values);
High significant - ○○○, significant - ○○, insignificant – ○ (negative values).

Table 4. The significance of differences between the growth means of shoots of *Ribes rubrum* varieties

Variety	t calculated	Degrees of freedom	t 5%	t 1%	t 0.5%	Significance*
Elite	0.15	20.04	2.086	2.845	3.153	x
Rolan	0.10	20.07	2.086	2.845	3.153	x
J van Tets	0.35	19.53	2.086	2.845	3.153	x
Tatran	-0.33	20.46	2.08	2.831	3.135	○
Detwar	-0.79	20.61	2.08	2.831	3.135	○

Table 5. Bunch weight variation for *Ribes nigrum* varieties

Greutatea ciorchinilor la soiurile de *Ribes nigrum* in anul III de la plantare				
No. crt.	Variety	Class limits (cm)	Centers of class (cm)	S%
1	Kzvana	0.4-11.00	1.16-10.24	54.41
2	Deea	1.03-15.87	2.09-14.81	52.62
3	Roxia	1.42-13.14	2.26-12.30	46.88
4	Tinker	0.85-10.51	1.54-9.82	48.91

Following the same pattern, in the case of *Ribes rubrum* species, the determinations for the weight of the bunches being in the mature stage, showed a high variability, S% coefficient having values between 43.47 and 69.18 g (Table 6).

The *Ribes rubrum* species shows two parts equal to 40% amongst the varieties that are distributed between 2 limits of the class variation for the weight of the bunches with

minimum values between 2.42 g and 2.55 g and maximum values between 2.94 g and 3.97 g (Figure 4). Regarding to the highest weight reached, have been highlighted varieties Rolan and Jonkheer van Tets.

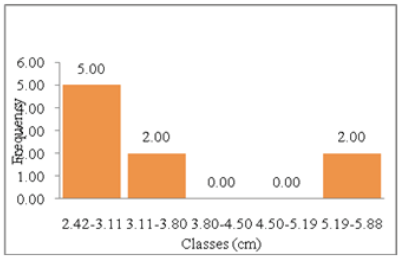

Figure 3. Weight of bunches histogram for *Ribes nigrum* varieties

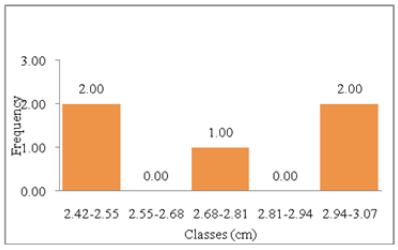

Figure 4. Weight of bunches histogram for *Ribes rubrum* varieties

Table 6. The significance of differences between the growth means of bunches of *Ribes nigrum* varieties

Variety	t calculated	Degrees of freedom	t 5%	t 1%	t 0.5%	Significance*
Kzvana	0.35	4.03	2.776	4.604	5.598	X
Deea	-0.33	5.17	2.571	4.032	4.773	○
Roxia	-0.27	4.92	2.571	4.032	4.773	○
Tinker	0.48	3.99	2.776	4.604	5.598	X

High significant - xxx, significant - xx, insignificant – x (positive values);
High significant - ○○○, significant - ○○, insignificant – ○ (negative values).

In terms of significance of differences between the average of *Ribes nigrum* bunches, comparing determined t value with the t value belonging to the 3 probabilities of transgression, the positive and negative differences are both insignificant (Table 7).
Under the aspect of significance of the differences between the weight means of bunches for the *Ribes rubrum* varieties, the difference of the means is insignificant (Table 8).

Table 7. The significance of differences between the growth means of bunches of *Ribes rubrum* varieties

Variety	t calculated	Degrees of freedom	t 5%	t 1%	t 0.5%	Significance*
Detwar	-0.24	6.73	2.365	3.499	4.029	○
Tatran	0.35	8.28	2.306	3.355	3.833	X
Elite	-0.24	8.34	2.262	3.25	3.69	○
Rolan	-0.20	6.78	2.365	3.499	4.029	○
J. van. Tets	0.47	8.53	2.262	3.25	3.69	x

High significant - xxx, significant - xx, insignificant – x (positive values);
High significant - ○○○, significant - ○○, insignificant – ○ (negative values).

Table 8. Berries weight variation for *Ribes nigrum* varieties

No. crt.	Variety	Class limits (cm)	Centers of class (cm)	S%
1	Kzvana	0.39-10.90	1.14-10.15	52.87
2	Deea	1.02-15.73	2.07-14.68	52.63
3	Roxia	1.41-13.06	2.24-12.23	47.4
4	Tinker	0.82-10.44	1.51-9.75	49.41

Another characteristic of production studied was the weight of berries. Therefore, the determination of the weight of berries showed a high variability, which was similar in the case of bunches weight variability analyzed. The coefficient of variation S% ranged between 47.4 - 52.87 in varieties of *Ribes nigrum* species (Table 9). In terms of berries weight variability characteristic, varieties detached have been Deea and Roxia class limits 1.02 - 15.73 g and 1.41 - 13.06 g.
Also, varieties of *Ribes rubrum* showed a high variability S% ranging from 44.51 to 70.3. In this regard have been remarked varieties Elite and Rolan, with class limits were between 0.66 - 13.14 and 0.22 - 10.38.

Table 9. Berries weight variation for *Ribes rubrum* varieties

No. crt.	Variety	Class limits (cm)	Centers of class (cm)	S%
1	Detwar	0.49-5.54	0.85-5.18	58.34
2	Tatran	0.41-8.05	0.96-7.50	70.3
3	Elite	0.66-13.14	1.55-12.25	66.99
4	Rolan	0.22-10.38	0.95-9.65	61.18
5	J. van. Tets	0.76-6.29	1.16-5.90	44.51

Following the calculations performed on the varieties of the *Ribes nigrum* species, a percentage of 25% of berries was distributed

between classes of variation with maximum values being in the ranges of 5.36 - 5.83 g (Figure 5). On this aspect was highlighted Deea variety.

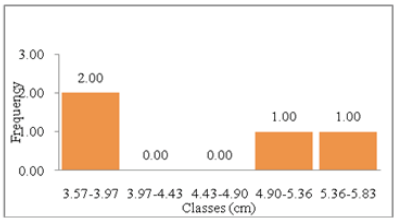

Figure 5. Weight of bunches histogram for *Ribes nigrum* varieties

About the weight of berries we can say that according to Figure 6, *Ribes rubrum* varieties have a 60% of berries distributed between class of variation with maximum values located between ranges 2.89 - 3.02. Therefore, Tatran, Elite and Jonkheer van Tets varieties were revealed.

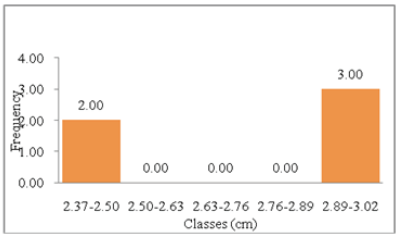

Figure 6. Weight of bunches histogram for *Ribes rubrum* varieties

Under the aspect of meaning, the differences of the means of berries weight of *Ribes nigrum* species, the difference of the means is insignificant (Table 10).

With regard to the weight of berries was emphasized being a slight weight difference between the averages of the *Ribes rubrum varieties* (Table 11).

The production of currants was expressed in tone per hectare and represents the biological production for the June - July period. The average production of bunches, berries and raceme/shrub was expressed in grams (Table 13). Also has been calculated the production for the shrub expressed in kilograms and tone per ha.

Table 10. Berries weight variation of *Ribes nigrum* varieties

Variety	t calculated	Degrees of freedom	t 5%	t 1%	t 0.5%	Significance*
Kzvana	0.54	3.98	2.776	4.604	5.598	○
Deea	-0.33	5.13	2.571	4.032	4.773	X
Roxia	-0.27	4.88	2.571	4.032	4.773	○
Tinker	0.48	3.95	2.776	4.604	5.598	○

High significant - xxx, significant - xx, insignificant – x (positive values);
High significant - ○○○, significant - ○○, insignificant – ○ (negative values).

Table 11. Berries weight variation of *Ribes nigrum* varieties

Variety	t calculated	Degrees of freedom	t 5%	t 1%	t 0.5%	Significance*
Detwar	-0.23	6.47	2.365	3.499	4.029	○
Tatran	0.34	8.00	2.306	3.355	3.833	X
Elite	-0.25	8.03	2.306	3.355	3.833	○
Rolan	-0.21	6.52	2.365	3.499	4.029	○
J. van Tets	0.46	8.24	2.262	3.25	3.69	X

High significant - xxx, significant - xx, insignificant – x (positive values);
High significant - ○○○, significant - ○○, insignificant – ○ (negative values).

The planting distances are 1.0 m per row and 2.5 m between the rows, which results a number of 4000 shrubs per ha. The production per ha (P) was determined using the following formula: P./ha (t/ha)= P./shrub (kg) x 4000 shrubs/ha.

After calculations, in terms of production, have been highlighted Roxie and Deea varieties, the latter having a production of 403.65 g bunches/shrub. The polar opposite was Tinker variety with a production of 56.69 g/shrub. Also, in terms of production per hectare was posted with Deea variety was dettached with over 50% more bunches compared to Roxia varieties, Kzvana and Tinker.

The most productive varieties of *Ribes rubrum* species were Rolan and Joankheer van Tets with an estimated production of 235.01g/shrub and 77.53 g/shrub.

Table 12. The production of *Ribe nigrum* species in the third year after planting

Variety	No. of shrubs	Bunches/ shrub (g)	Berries/ shrub (g)	Raceme/ shrub (g)	Bunches/ variety (kg)	Bunches (t/ha)	Berries (kg)	Berries (t/ha)	Raceme (kg)	Raceme (t/ha)
Kzvana	5	114.34	111.95	2.39	0.572	457.36	0.560	447.8	0.010	9.56
Deea	12	403.65	398.5	5.15	4.844	1614.6	4.782	1594	0.062	20.60
Roxia	14	268.29	265.62	2.67	3.756	1073.16	3.71868	1062.48	0.037	10.68
Tinker	16	56.69	56.24	0.45	0.907	226.760	0.900	224.960	0.007	1.80

Table 13. The production of *Ribe rubrum* species in the third year after planting

Variety	No. of shrubs	Bunches/ shrub (g)	Berries/ shrub (g)	Raceme/ shrub (g)	Bunches/ variety (kg)	Bunches (t/ha)	Berries (kg)	Berries (t/ha)	Raceme (kg)	Raceme (t/ha)
Detwar	4	33.9	33.23	0.67	0.136	135.6	0.133	132.92	0.003	2.68
Tatran	7	47.61	46.9	0.71	0.333	190.44	0.3283	187.6	0.005	2.84
Elite	16	25.32	24.55	0.77	0.405	101.28	0.3928	98.2	0.012	3.08
Rolan	10	235.01	230.67	4.34	2.350	940.040	2.307	922.680	0.043	17.36
J. van Tets	7	77.53	76.46	1.07	0.54	310.12	0.5352	305.84	0.01	4.28

CONCLUSIONS

With regard to the variability of the characteristic length of shoots, the Ribes nigrum varieties Abanos and Elita 124 had the maximum length of 84.5 cm or 82.00 cm. Ribes rubrum varieties Elite and Detwar had increases of up to 59.00 cm and 41.80 cm. Both species had a high variability of the length of shoots, which reflects the importance of the environment conditions on this phenotypic characteristic as well as for the biological diversity of the varieties taken into study.

The highest weight of the bunches was determined for the *Ribes nigrum* varieties Deea and Roxia, with 15.87 g and 13.14 g/bunch respectively, and for the Ribes rubrum species, emphasizing Rolan and Jonkheer van Tets varieties.

The S% variability coefficient for the weight of bunches showed values between 47.4 and 52.87, for *Ribes nigrum*, and for *Ribes rubrum* even higher, up to 70.3.

The calculated production per varieties showed that the highly productive variety of blackcurrant is Deea, with a production of 1614.16 t bunches/ha, followed by the redcurrant variety Rolan, with a production of 940 t bunches/ha.

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