

Evaluation of field collection of wild *Rubus idaeus*

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Annotation

A natural diversity of wild raspberry (*Rubus idaeus* L.) with the stress on fruit and related properties of the species was studied in the field collection established in the Botanical Garden of Vilnius University. 49 accessions were taken for the evaluation purposes in the collection established from wild-collected vegetative plant material covering nearly all parts of Lithuania. The properties assessed were fruit weight, number of drupelets, fruit length and width, florican height and diameter, flower diameter. The most distinguishing accessions were selected and correlations between some characters established.

Keywords: *Rubus idaeus*, raspberry, field collection, accession, correlation

INTRODUCTION

Red raspberry, *Rubus idaeus* L., a wild progenitor of the garden raspberry, is an extensively distributed species all over the temperate zone of the northern hemisphere. An immense morphological variability has been reported for the species (Haskell, 1960; Keep, 1972; Rousi, 1965). *R. idaeus* occupies a wide range of habitats from unfertile sands to humus-rich soils with a variable pH and moisture content. In southern latitudes it grows at higher altitudes. High adaptability to the environmental conditions in combination with rapid seed and

vegetative dispersal patterns resulted in a vast genetic diversity of the species. For Lithuania this was just recently proved (Patamsytė et al., 2008; Žvingila et al., 2004). Thus, wild forms of this species have been and remain an essential source of genes for the breeding of new, improved cultivars. Important traits for the cultivars are those affecting plant habit, yield, fruit quality and resistance to diseases and pests. For cultivation and, particularly, for the breeding it is very important to have as full evaluation of an accession as possible. Therefore, the objective of the current study was to evaluate raspberry accessions for their performance in the field collection with the stress on fruit and related characteristics.

MATERIAL AND METHODS

A field collection of wild raspberry (*Rubus idaeus* L.) was established in the Botanical Garden of Vilnius University from wild-collected plant material in 2001-2003 as described in (Balčiūnienė et al., 2005). Measurements and assessments were made in the field collection during the growth periods from 2003-2007. The 49 accessions covering almost all the territory of Lithuania were evaluated. The quantitative morphological characters, such as fruit weight, number of drupelets, fruit length and width, florican height and diameter, flower diameter, were studied including length width ratio of fruit for the estimation of shape index. 10 ripe aggregate fruits per accession were used for the evaluation of morphological characters. The data were processed statistically to obtain means and standard deviations, as well as regression and correlation analyses were performed with MS Excel.

RESULTS AND DISCUSSION

The obtained data are summarised in the Table 1. Although high variation was observed in most of the variables studied, some of the accessions distinguished among others significantly. The heaviest fruit were borne by the SS01, JL32 and JL35 accessions with 1.01, 0.93 and

0.92 g per aggregate fruit, respectively. Considering fruit weight as one of the most important economic property we have tried to establish correlations between fruit weight and the rest of characters studied. The regression analysis showed that fruit weight best correlated with fruit length ($R=0.88$) and, particularly, with fruit diameter ($R=0.93$). This suggests that raspberry fruit diameter could be measured in order to approximately estimate their weight. Fruit weight covered the range of variation between accessions from 0.32-1.01 g, with the difference between maximum and minimum values of 3.16 times. A similar range of variation in fruit size was reported from Finland (0.6-1.6 g) (Rousi, 1965) and Britain (Haskell, 1960), considering small size of berries as a major drawback for using wild raspberries in breeding. The number of drupelets per aggregate fruit varied from 24.00-57.75 with the max-min difference of 2.41 times. These two characters were the most variable among the all studied. However, the correlation between fruit weight and number of drupelets was moderate, $R=0.59$. This means that drupelets vary considerably not only in number but also in their size which is in agreement with the observations reported by Moore (1993). With this regard two accessions are interesting, JL32 and JL35. They produce relatively large fruit (0.93 and 0.92 g, respectively) aggregated of relatively small number of drupelets (38.1 and 41.1, respectively). While estimating fruit size its length and width were measured as well as length to width ratio, or shape index calculated. The same accessions SS01 and JL32 distinguished by the dimensions of length and width. Length and width values showed quite strong positive correlation, $R=0.85$. The mean shape index varied between accessions from 0.79-1.04. We subdivided this range into three groups: (1) 0.76-0.85, (2) 0.86-0.95, and (3) 0.96-1.05. The first group with relatively shortest and widest fruit could be called oblate fruit group. The most expressed character of this type was in the accession JL18. This group amounted up to 14.3 % accessions. The second group could be assigned with the name globose. Its best representatives were the accessions JL08, JL65, JL37, JL40 and IŽ01, i.e. those closest to the overall average. This is the largest group of the accessions studied, comprising 55.1 %. The third group, round-fruit, made up 30.6 % of all accessions. JL45 and JL36 were the best representatives of the round-fruit group accessions. It

must be pointed out that the terms oblate, globose and round do not exactly describe the shape of fruits in this study as only two-dimensional linear measurements were carried out on fruit.

Floricanes height and diameter at the height of 30 cm showed moderate correlation, $R=0.45$. The tallest floricanes were produced by the accessions JL36, JL33 and JL35 with the heights of 1.68, 1.66 and 1.60 m, respectively. Total floricanes height variation between accessions was from 0.84-1.68 m. As reported from Scotland (Jennings, 1964), the cane height variation is one of the few raspberry characters related to altitude. The thickest floricanes were observed in the accessions JL35, JL33 and JL06 amounting up to 0.92, 0.88 and 0.87 cm, respectively. Thus, the most vigorous floricanes were in two accessions, JL33 and JL35. The latter accession also produced one of the largest flowers, 2.24 cm in diameter (total variation from 1.49-2.35 cm). There were observed no correlation between flower diameter and any other character evaluated except of a floricanes diameter where a moderate correlation was established ($R=0.41$). The most slender floricanes estimated as the ratio between height and diameter were the accessions JL12, JL36 and JL04. Their heights exceeded diameter more than 232,

Table 1. Fruit-related characters of *R. idaeus* accessions (M \pm SD) in the field collection

Accession	Fruit weight, g	Number of drupelets in a fruit	Fruit length, mm	Fruit diameter, mm	Floricanes height, m	Floricanes diameter at height 30 cm	Flower diameter, cm
JL01	0.43 \pm 0.03	39.00 \pm 8.34	9.20 \pm 0.28	10.50 \pm 0.28	1.18 \pm 0.03	0.85 \pm 0.03	1.91 \pm 0.04
JL02	0.39 \pm 0.01	34.65 \pm 1.48	9.70 \pm 0.57	10.45 \pm 0.21	1.13 \pm 0.22	0.80 \pm 0.04	2.17 \pm 0.13
JL03	0.46 \pm 0.01	36.75 \pm 6.01	9.50 \pm 0.85	9.90 \pm 0.71	0.94 \pm 0.19	0.59 \pm 0.29	1.75 \pm 0.13
JL04	0.41 \pm 0.02	32.20 \pm 5.66	8.20 \pm 0.99	9.95 \pm 0.49	1.44 \pm 0.03	0.63 \pm 0.03	1.87 \pm 0.16
JL05	0.55 \pm 0.10	41.15 \pm 10.82	11.80 \pm 0.00	11.40 \pm 0.00	1.29 \pm 0.11	0.68 \pm 0.05	1.49 \pm 0.27
JL06	0.46 \pm 0.05	42.29 \pm 5.11	9.37 \pm 1.46	10.12 \pm 1.11	1.18 \pm 0.08	0.87 \pm 0.06	2.10 \pm 0.00
JL07	0.72 \pm 0.27	38.70 \pm 5.23	11.45 \pm 2.33	12.00 \pm 1.41	1.20 \pm 0.21	0.63 \pm 0.12	1.92 \pm 0.11
JL08	0.69 \pm 0.12	38.40 \pm 3.11	10.80 \pm 0.28	12.00 \pm 0.00	1.50 \pm 0.10	0.70 \pm 0.17	2.01 \pm 0.04
JL09	0.75 \pm 0.05	42.90 \pm 5.80	12.30 \pm 0.42	12.75 \pm 0.07	1.56 \pm 0.11	0.70 \pm 0.13	2.18 \pm 0.00
JL10	0.59 \pm 0.02	46.60 \pm 4.38	11.10 \pm 0.28	11.75 \pm 0.21	1.54 \pm 0.08	0.68 \pm 0.04	1.78 \pm 0.00
JL11	0.58 \pm 0.04	33.40 \pm 3.11	9.85 \pm 0.35	11.75 \pm 0.07	1.24 \pm 0.10	0.64 \pm 0.05	1.58 \pm 0.06

JL12	0.55±0.08	36.75±1.20	10.60±0.42	11.05±0.21	1.51±0.04	0.65±0.00	1.66±0.06
JL13	0.46±0.13	47.65±16.33	10.05±1.20	10.25±0.78	0.97±0.19	0.61±0.15	1.73±0.04
JL14	0.32±0.05	28.31±9.06	8.31±0.58	9.70±0.42	1.48±0.14	0.75±0.03	1.57±0.09
JL15	0.55±0.13	38.70±4.67	9.70±1.41	11.25±0.64	1.09±0.14	0.62±0.13	1.58±0.25
JL16	0.86±0.08	56.50±5.37	13.10±1.41	12.95±0.49	1.39±0.12	0.69±0.07	2.14±0.08
JL17	0.49±0.08	35.30±17.96	10.35±0.92	10.75±0.07	1.35±0.09	0.68±0.14	1.67±0.07
JL18	0.56±0.10	37.51±0.16	9.43±0.25	11.88±0.18	1.46±0.05	0.74±0.05	1.54±0.06
JL19	0.50±0.20	43.45±0.64	9.80±0.99	10.55±1.06	1.51±0.25	0.69±0.09	1.62±0.22
JL20	0.47±0.04	37.27±1.32	10.12±0.31	10.88±0.40	1.27±0.14	0.61±0.08	2.15±0.58
JL22	0.66±0.10	39.75±1.06	10.73±1.66	12.38±1.16	1.40±0.02	0.70±0.16	2.08±0.12
JL23	0.85±0.09	51.00±0.57	12.45±0.21	13.15±0.21	1.16±0.44	0.63±0.20	1.83±0.38
JL25	0.45±0.04	40.65±15.06	9.80±0.71	10.50±0.00	1.44±0.19	0.74±0.03	1.63±0.15
JL32	0.93±0.06	38.10±5.23	11.75±0.35	14.05±0.6	1.40±0.20	0.72±0.04	1.82±0.02
JL33	0.71±0.17	47.15±2.19	10.80±0.57	12.15±0.78	1.66±0.15	0.88±0.01	2.08±0.00
JL34	0.71±0.21	46.85±4.45	11.50±1.56	12.30±1.13	1.42±0.24	0.69±0.08	1.76±0.00
JL35	0.92±0.09	41.05±0.21	11.90±0.28	12.85±0.64	1.60±0.09	0.92±0.15	2.24±0.03
JL36	0.70±0.03	40.35±5.30	11.70±0.28	11.70±0.72	1.68±0.10	0.73±0.05	2.06±0.29
JL37	0.60±0.04	32.50±5.23	10.20±1.70	11.30±0.71	1.22±0.03	0.78±0.07	1.95±0.04
JL39	0.47±0.16	35.95±0.07	10.39±1.18	10.56±2.20	1.21±0.08	0.60±0.11	1.88±0.20
JL40	0.62±0.04	45.50±10.47	10.35±1.06	11.35±0.07	1.22±0.21	0.78±0.07	1.93±0.00
JL41	0.35±0.02	24.00±0.99	8.35±0.07	10.00±0.28	1.37±0.15	0.75±0.13	2.17±0.00
JL42	0.49±0.20	47.27±14.62	9.99±2.13	9.75±1.91	1.39±0.07	0.68±0.11	1.65±0.00
JL43	0.47±0.02	29.05±8.98	9.35±0.07	10.95±0.78	1.56±0.11	0.82±0.21	1.88±0.03
JL44	0.77±0.06	39.35±7.71	11.95±0.64	12.25±0.07	1.52±0.07	0.78±0.02	1.88±0.17
JL45	0.88±0.31	44.30±3.39	12.40±2.26	12.45±1.48	1.55±0.02	0.77±0.16	2.04±0.01
JL47	0.56±0.05	37.40±4.24	9.40±0.00	11.30±0.00	1.38±0.05	0.73±0.08	1.65±0.02
JL52	0.44±0.10	41.74±14.08	9.53±0.19	10.11±0.16	1.36±0.10	0.65±0.04	1.64±0.15
JL54	0.65±0.14	32.98±0.82	10.03±0.45	11.46±0.93	1.24±0.08	0.67±0.17	1.61±0.04
JL56	0.50±0.07	35.50±2.55	10.05±1.48	10.30±0.14	1.31±0.24	0.79±0.19	2.35±0.12
JL61	0.46±0.11	37.80±2.12	9.60±0.14	10.30±0.85	1.30±0.03	0.66±0.02	1.65±0.12
JL64	0.64±0.07	48.30±14.14	11.65±1.91	12.45±2.05	1.51±0.14	0.83±0.14	1.94±0.00
JL65	0.53±0.06	40.90±4.67	9.55±0.07	10.60±0.71	1.23±0.39	0.69±0.22	1.92±0.00
JL72	0.65±0.12	56.05±6.01	10.95±0.07	11.40±1.13	1.55±0.18	0.72±0.10	1.65±0.00
JL76	0.63±0.12	47.61±12.00	11.15±0.92	11.45±0.78	1.48±0.13	0.85±0.16	1.86±0.00
LB01	0.74±0.05	41.70±0.71	11.20±0.14	11.75±0.07	0.84±0.06	0.60±0.16	1.72±1.01
LB02	0.73±0.24	50.52±8.74	10.95±1.34	11.74±1.36	1.49±0.08	0.71±0.17	2.04±0.32
IŽ01	0.40±0.09	27.06±2.13	8.34±0.48	9.13±0.35	1.12±0.14	0.70±0.16	2.03±0.60
SS01	1.01±0.00	57.75±7.57	12.90±0.57	13.65±0.07	1.43±0.21	0.81±0.19	1.73±0.00
Average	0.60±0.16	40.43±7.14	10.48±1.21	11.33±1.10	1.35±0.19	0.72±0.08	1.86±0.22
Range	0.32–1.01	24.00–57.75	8.20–13.10	9.13–14.05	0.84–1.68	0.59–0.92	1.49–2.35

230 and 229 times, respectively. While the stumpiest accessions were JL06, JL01 and LB01 with their heights exceeding diameters by less than 136, 139 and 140 times, respectively.

CONCLUSIONS

Several accessions of *R. idaeus* could be selected by more than one morphological property studied. Those are SS01 and JL32, distinguishing by fruit weight and size; JL35 – by fruit weight, floricane dimensions and flower size; JL33 – by floricane dimensions; JL23– by fruit dimensions. The accessions JL32 and JL35 also distinguish by 29–34 % lower number of drupelets. The highest variations among the characters studied were observed in fruit weight and number of drupelets per aggregate fruit (3.16 and 2.41 times, respectively).

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PAPRASTOSIOS AVIETĖS (*RUBUS IDAEUS* L.) LAUKO KOLEKCIJOS ĮVERTINIMAS

S a n t r a u k a

Vilniaus universiteto Botanikos sodo lauko kolekcijoje buvo tiriama paprastosios avietės (*Rubus idaeus* L.) 49 kolekcinų pavyzdžių gamtinė įvairovė. Aviečių lauko kolekcija įkurta 2001–2003 m. ir apima pavyzdžius iš beveik visų Lietuvos rajonų. Kolekcija vertinta matuojant tokius kiekybinius morfometrinius rodiklius kaip sudėtinio vaisiaus masė, kaulavaisiukų skaičius, vaisiaus ilgis bei plotis, derančio stiebo aukštis bei storis, žiedo skersmuo. Taip pat įvertinti santykiniai rodikliai – sudėtinio vaisiaus ilgio ir pločio santykis (formos indeksas) bei derančio stiebo aukščio ir diametro santykis. Nustatyta labai stipri koreliacija tarp vaisiaus masės ir diametro ($R=0,93$) bei masės ir ilgio ($R=0,88$). Užfiksuotas stiprus koreliacinis ryšys tarp vaisiaus ilgio ir pločio ($R=0,85$) bei vidutinio stiprumo – tarp vaisiaus masės ir kaulavaisiukų kiekio jame ($R=0,59$). Didžiausia variacija iš tirtų rodiklių išsiskyrė vaisiaus masė ir kaulavaisiukų skaičius jame, taip pat stebėta didelė derančių stiebų aukščio variacija. Vykdam atranką pagal tirtus morfometrinius rodiklius, verti dėmesio yra šie kolekciniai pavyzdžiai: SS01, JL32, JL33, JL35 ir JL23.

Reikšminiai žodžiai: *Rubus idaeus*, paprastoji avietė, lauko kolekcija, kolekcinis pavyzdys.