Quantitative analysis of the berry size in grapevine cultivar 'Italia'

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Introduction

Grapevine (*Vitis vinifera* L.) is one of the most important horticultural crops where appearance, for example bunch size and compactness, berry size, shape and color highly influence the table grape consumers' decision. Ampelographic literatures (Barbagallo et al., 2011) and official descriptors detail berry size classes (OIV, 2009), which measured for example with ruler (Frege, 1804), with caliper (Kircherer et al., 2013) or with digital image analysis (Roscher et al., 2014). There are several image analysis softwares, which are dealing with mostly the size of different parts of horticultural crops. "Tomato Analyzer" for example evaluates the perimeter and the area, the maximum width and height, the width at mid height and the height at mid width also. The program can evaluate different fruit shape indexes, the "Fruit shape index external I" which is the ratio of the maximum height and maximum width and "Fruit shape index external II" being the ratio of the height mid width and width mid height. The "Proximal fruit blockiness" and "Distal fruit blockiness" show the ratio of the upper (proximal) and the lower (distal) thirds ratios to the width mid height. Furthermore, the asymmetry of the fruit can be described with the help of the software (Rodríguez et al., 2010). The purpose of this study was to evaluate the berry morphological traits of the grapevine cultivar 'Italia' influenced by the seed number of the berries, and compare samples collected from two different vineyards.

Materials and Methods

- Samples collected from the Institute for Viticulture and Oenology of the Hungarian University of Agriculture and Life Sciences (Kecskemét, Hungary) and from the Kun Szőlő Nursery and Table Grape Plantation (Kővágótöttös, Hungary).
- Ten bunches were collected and of each bunches 15-15 berries were randomly sampled from the middle third of the bunches.
- Digitlization: Epson V370 scanner (Seico Epson Corporation, Japan) at 200 dpi
- Investigated traits:
  - Weight (Ohaus Explorer Pro EP114C)
  - Seed number
  - Quantitative traits: Perimeter, Area, Width Mid-height, Maximum Width, Height Mid-width, Maximum Height, Curved Height, fruit shape indices: Fruit Shape Index External I, Fruit Shape Index External II, Curved Fruit Shape Index (Tomato Analyzer (Brewer et al., 2006))
- Statistical analysis of the data: summary statistics and ANOVA (PAST, Hammer et al, 2001)

Results

In case of the investigated size traits there were no significant differences of the values of the two locations. While the examined shape traits, namely Fruit Shape Index External I and II had noticable differences according to the growing sites, though had no significant effects in case of the third shape trait- Curved Fruit Shape Index.

The investigated samples had 0 to 4 seeds per berry which is in accordance of the literatures. Most berries had 1 or 2 seeds (37.58% and 33.89% of the sample set respectively). Data showed that seed number had significant effect on the size and shape traits (Table 1, Figure 2). Smallest berries were the seedless ones with 2.8 g in average while those with 4 seeds had 8.01 g. The most uniform berry weight was observed in the case of 4 seeded berries (Coeff. Var = 11.64%). Perimeter was the smallest in the case of seedless berries (63.69 mm) while the largest were the 4-seeded ones (84.94mm). Area of the berries also significantly changed caused by the different seed numbers. Variability of the values within each groups were the lowest in the 4-seeded berries while the highest values were recorded in the case of the seedless ones. Low variability was observed in the fruit shape index and there was no significant difference among the samples with different seed numbers.
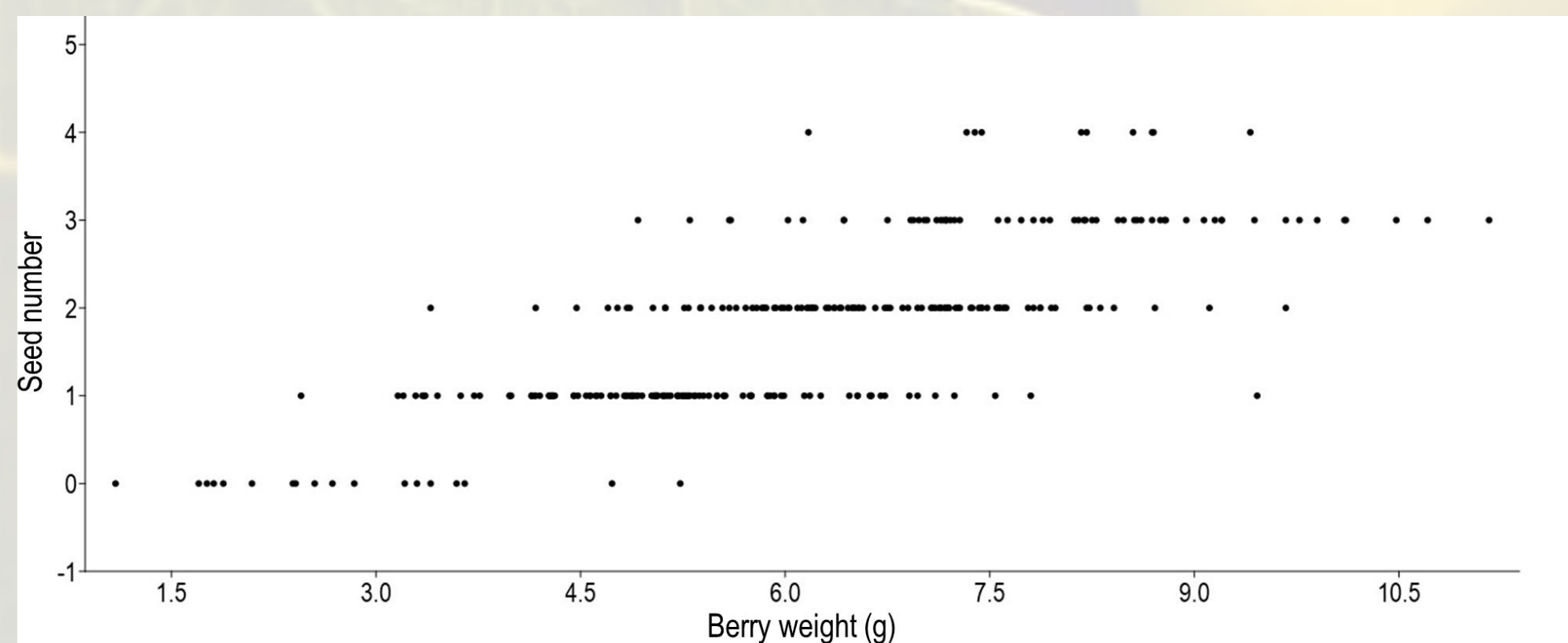

Figure: Berry morphological traits investigated with the Tomato Analyzer (Brewer et al., 2006)

Figure 2: Berry weight of the 'Italia' grapevine cultivar influenced by the seed number

Table: Berry morphological traits of the'Italia'grapevine cultivar influenced by the seed number

Morphological trait	Seed number	Mean	Min	Max	Stand. dev	Coeff. var.
		Size traits				
Berry weigth (g)	0	2,8[a]	1,09	5,23	1,08	38,51
	1	5,14[b]	2,45	9,46	1,08	21,09
	2	6,59[c]	3,4	9,67	1,09	16,56
	3	8[d]	4,92	11,16	1,38	17,31
	4	8,01[d]	6,17	9,41	0,93	11,64
Perimeter (mm)	0	63,69[a]	55,5	74,4	6,4	10,05
	1	72,51[b]	59,8	95,74	6,17	8,51
	2	79,34[c]	63,8	93,34	5,42	6,83
	3	83,56[d]	72,69	91,9	4,67	5,59
	4	84,94[d]	80,18	93,84	4,76	5,6
Area (mm²)	0	274,11[a]	216,64	387,77	53,97	19,69
	1	365,82[b]	226,61	513,55	51,94	14,2
	2	437,78[c]	287,84	549,58	49,8	11,38
	3	495,43[d]	375	593,64	54,96	11,09
	4	496,69[d]	447,93	588,63	42,65	8,59
Width Mid-height (mm)	0	17,08[a]	14,86	19,94	1,71	10,01
	1	19,6[b]	14,86	24,51	1,69	8,6
	2	21,25[c]	17,27	24,77	1,51	7,1
	3	23,01[d]	19,43	27,69	1,61	7
	4	22,96[d]	20,57	24,51	1,29	5,61
Maximum Width (mm)	0	17,3[a]	15,11	20,07	1,74	10,05
	1	19,96[b]	15,24	24,77	1,64	8,22
	2	21,57[c]	17,65	24,77	1,46	6,77
	3	23,2[d]	19,81	27,69	1,57	6,77
	4	23,33[d]	21,46	24,64	1,02	4,36
Height Mid-width (mm)	0	20,08[a]	17,91	24,51	2,09	10,42
	1	22,72[b]	15,75	26,8	2,36	10,37
	2	25,07[c]	16	29,46	2,37	9,47
	3	26,63[d]	21,97	31,62	1,95	7,31
	4	26,28[cd]	19,05	30,23	2,92	11,11
Maximum Height (mm)	0	20,61[a]	17,91	24,64	2,1	10,19
	1	23,39[b]	19,18	27,94	1,89	8,1
	2	25,85[c]	21,08	31,24	1,86	7,2
	3	26,96[d]	22,61	31,75	1,77	6,57
	4	27,13[cd]	25,53	30,73	1,61	5,93
Curved Height (mm)	0	23,16[a]	19,22	26,58	2,48	10,71
	1	26,35[b]	20,93	32,05	2,46	9,33
	2	28,87[c]	23,44	34,63	2,24	7,76
	3	30,57[d]	25,09	36,2	2,2	7,18
	4	30,62[cd]	28,13	33,82	2,05	6,68
		Shape traits				
Fruit Shape Index External I	0	1,2	1,06	1,4	0,08	6,88
	1	1,18	0,97	1,41	0,09	7,28
	2	1,2	0,99	1,45	0,1	8,01
	3	1,17	0,96	1,36	0,09	7,6
	4	1,16	1,09	1,28	0,06	5,21
Fruit Shape Index External II	0	1,19	1,07	1,31	0,07	6,26
	1	1,16	0,85	1,48	0,11	9,15
	2	1,18	0,83	1,49	0,12	9,93
	3	1,16	0,95	1,36	0,1	8,22
	4	1,14	0,93	1,29	0,1	8,56
Curved Fruit Shape Index	0	1,33	1,11	1,58	0,12	9,27
	1	1,33	1,13	1,64	0,11	8,06
	2	1,35	1,09	1,67	0,12	8,79
	3	1,32	1,05	1,57	0,1	7,68
	4	1,32	1,19	1,41	0,08	5,8

Different letters indicate significant differences (p<0,05)

Conclusions

Grapevine berry shape and size are traits affected by many factors. Such factors could be environmental or developmental factors. According to this research we found no significant differences in the fruit traits of samples collected from different locations, but it can be stated, that seed number influences significantly the size of the grapevine berries.
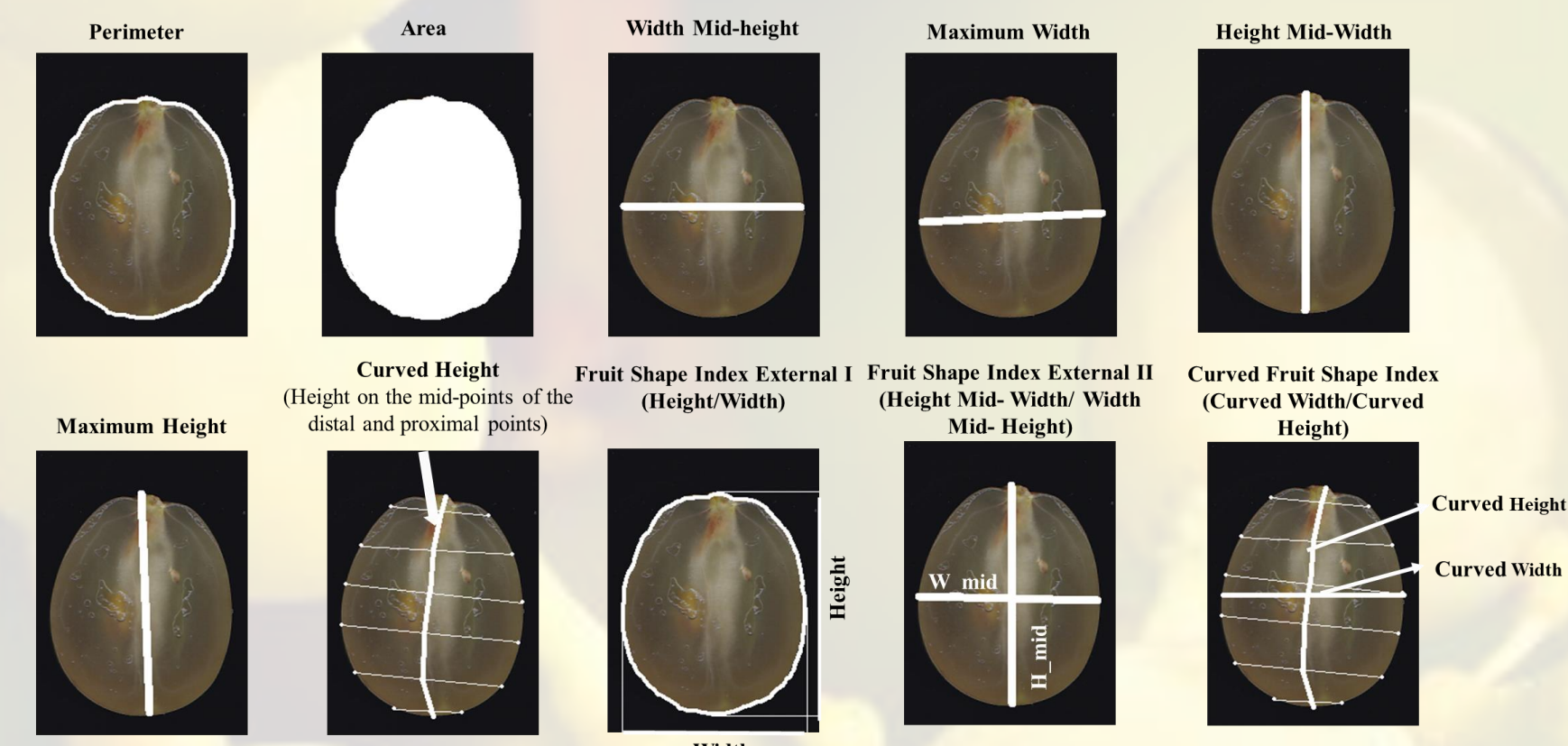
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