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BREEDING NEW LOW TRELLIS HOPS IN CZECH REPUBLIC

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INTRODUCTION:

In the past hop breeding in Czech Republic was based just on clonal selection with the aim to improve Saazer. Nevertheless, the objectives have changed considerably recently. Hop cones contain numerous important compounds for brewing industry, pharmaceutical and bio-medicine (De Keukeliere et al., 2003; Pšenáková et al., 2010). Technological changes in hop growing have been made recently, including low trellis systems (Nesvadba et al., 2001). Whereas classic technology consists in hop growing in a 7m high trellis system, low trellis is just 3m tall. This change brings about lower need of labor and pesticides. The reason why there are no convenient varieties at disposal lies in low interest of hop growing countries, except the UK (Glendinning, 2009). Nevertheless, problems with the lack of seasonal labor and high costs connected with it have made hop growers try to change their traditional system of hop growing. Therefore, we have made contact with our English colleagues who are more experienced in this unusual system of hop growing to help us to get suitable dwarf varieties for cultivation in CR.

MATERIAL AND METHODS:

We obtained 19,000 seeds from the crossings realized in the UK in 2010. Saazer - Osvald clone no. 31 was used for the crossing. It was pollinated by English male plants from the collection of the unique gene fond of dwarf hops. For hop crossing carried out in CR four mother plants with dwarf characteristics were chosen from the breeding collection. Totally 3,800 seeds were obtained from free pollination. The first assessment of hop plants was carried out in 2011. Qualitative features were evaluated in all the plants. On the base of these results we selected the best ones with the aim to get new genotypes suitable for growing in low trellises. Length and position of internodes, habitus of hop plants and tolerances to diseases were the most important assessed characteristics (Darby, 2001). Totally 114 genotypes were chosen for the further study. Descriptions before harvest were made. We evaluated bine color, number of bines, length and position of fertile laterals, size of cones as well as tolerance to diseases and pests. In the selected perspective genotypes hops were harvested by hand and hop yield was determined. In all the samples chemical analyses aimed at hop resins (liquid chromatography – HPLC, EBC 7.7) and essential oils (gas chromatography) were carried out.

RESULTS AND DISCUSSION:

Qualitative features were evaluated in all the plants as the base for the selection with the objective to get new genotypes suitable for growing in low trellises. Length of internodes and position of fertile laterals were the most important characteristics together with the growths of plants and tolerances to diseases. Totally 58 perspective genotypes were chosen for further breeding (Table 1). Bine color, number of bines, length and position of fertile laterals, size of hop cones and tolerance to pests and diseases were evaluated before harvest. The best genotypes were harvested so as to get their yields in kilograms of fresh hops per plant. Chemical analyses of hop cones and sensory perception evaluations were carried out as well. Perspective genotypes are shown in Table 2. The best genotype PG/2/8 reached the yield of 3.52 kg of fresh hops per plant. If we take into consideration the spacing of 0.75 x 3.0 m and conversional coefficient of dry matter 4, we can conclude that potentially it is possible to get a crop of 3.85 t of dry hops per hectare. It is by far the best yield as the other perspective genotypes show the highest yield at the level of 2.4 t/ha, and 2.2 t/ha respectively. Many genotypes also show higher contents of alpha acids. Ten best genotypes with the highest contents of alpha acids are shown in Table 3. Two of them have alpha acid contents higher than 15 %. Very perspective seems to be genotype 37/26/3 with the yield of 1.73 kg/plant, which is nearly two tons of dry hops per hectare. Table 4 shows genotypes with low ration between alpha and beta acids, which is typical for aroma hops. These genotypes have the ratio maximally 1.5 and the range of alpha acid contents between 4.94 and 8.09%. Many genotypes show high yield at the level of 1.2 kg/plant. It is interesting that they are specific by wide variability in the percentage of cohumulone (18.9 – 40.8% rel.).

Table 1: Success in breeding selections

No.	Origin	Number	Selection	Success
H 14	34/5/1/9 x OP	272	0	0 %
H 15	34/4/0/1 x OP	554	2	0.36 %
H 16	33/2/8/8 x OP	578	0	0 %
H 18	5259 x OP	489	0	0 %
H 19	Saazer x 73/98/12	1,003	5	0.5 %
H 20	Saazer x 35/91/62	3,806	6	0.16 %
H 21	Saazer x 73/98/54	2,006	44	2.19 %
H 37	Taurus x English dwarf male	810	1	0.12 %
H 39	Saazer x 25/87/34	720	0	0 %
Total		**10,238**	**58**	**0.57 %**

Table 2: Hop genotypes with the highest yields

Genotype			**Yield**	Alpha acids	Beta acids	*Ratio*	Cohumulone
H	R	P	**((kg/plant)**	(% w.w.)	(% w.w.)	*alpha/beta*	(% rel.)
PG	2	8	**3.52**	6.47	3.89	*1.7*	23.3
MA	2	21	**2.20**	7.70	4.24	*1.8*	29.7
38	16	1	**2.00**	10.81	5.49	*2.0*	30.6
38	10	1	**1.92**	8.81	4.66	*1.9*	32.0
MA	2	40	**1.87**	2.72	1.29	*2.1*	14.8
33	3	1	**1.85**	4.94	3.48	*1.4*	36.3
PG	3	1	**1.77**	5.43	2.32	*2.3*	32.8
37	26	1	**1.73**	12.93	5.07	*2.6*	39.0
37	23	2	**1.56**	7.79	3.04	*2.6*	24.0
39	30	1	**1.53**	7.03	6.37	*1.1*	26.0

Table 3: Hop genotypes with the highest contents of alpha acids

Genotype			Yield	**Alpha acids**	Beta acids	*Ratio*	Cohumulone
H	R	1	((kg/plant)	**(% w.w.)**	(% w.w.)	*alpha/beta*	(% rel.)
37	22	2	0.52	**15.48**	4.83	*3.2*	22.7
37	22	4	0.89	**15.06**	5.01	*3.0*	30.0
37	23	2	0.80	**13.48**	4.78	*2.8*	37.8
37	22	1	0.80	**13.17**	4.97	*2.6*	36.1
37	21	1	0,86	**13.01**	3.78	*3.4*	29.1
37	26	3	1,73	**12.93**	5.07	*2.6*	39.0
37	21	6	1.33	**12.59**	3.79	*3.3*	26.4
38	11	2	0.99	**11.97**	5.53	*2.2*	34.3
37	25	3	1.02	**11.95**	3.74	*3.2*	24.7
38	16	1	0.96	**11.67**	5.32	*2.2*	32.5

Table 4: Aroma hop genotypes

Genotype			Yield	Alpha acids	Beta acids	***Ratio***	Cohumulone
H	R	P	((kg/plant)	(% w.w.)	(% w.w.)	***alpha/beta***	(% rel.)
PG	3	7	1.20	5.90	5.98	***1.0***	26.2
38	9	1	1.02	8.09	7.45	***1.1***	28.8
39	30	1	1.53	7.03	6.37	***1.1***	26.0
39	33	6	0.92	7.29	6.52	***1.1***	18.9
39	34	2	0.76	6.91	5.97	***1.2***	23.2
39	34	6	0.52	6.74	5.73	***1.2***	20.2
52	7	9	0.82	6.27	5.08	***1.2***	40.8
33	3	1	1.85	4.94	3.48	***1.4***	36.3
33	3	5	0.52	6.21	4.10	***1.5***	35.9
33	3	5	0.52	6.21	4.10	***1.5***	28.5

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