

STUDIES REGARDING THE QUANTITATIVE CHARACTERS OF THE CONES AT SEVERAL HOPS CULTIVARS

**Cernea S., L.S. Muntean, Al. Salontai, G. Morar, Maria Tofană,
M.M. Duda, D.I. Vârban, S. Muntean, Simona Oros**

Key words: hop; morphological characters; variability; cones production; alpha acids

Abstract. There were studied six Romanian hops cultivars regarding some morphological characters of the cones and productivity and qualitative characters in the conditions from Cluj-Napoca.

The results of the experimental year s show hops cultivar are characterized by a large phenotypical variability of the morphological characters of cones. The hops cultivars taken into study were represented by Superalfa de Cluj, Productiv, Transilvania and Aroma, with cones of average size, a fine rachis and a large number of bract, accomplish productions of alpha acids of 173,1-278,5 kg/ha.

The productivity characters of the hops cultivars taken into study as the bract characters are influenced by the morphological characters of hops cone. The elements of the cones – the bract and the rachis- have a great variability within the hops genotypes.

In the amelioration process of hops the goal is represented by the fact that the future creations to be characterized by a report between rachis and bract as favorable as possible for the bract, because at their base it is stored de lupuline grains, which has an important role regarding the level of the production and the bitter substances.

Scientific literature has few dates regarding the morphological structure of cones, and those existent have at their base studies regarding other hops cultivars different from the ones taken into culture in our country. In our country there were made research in this direction by Salontai and his collaborators (1978), Cernea and his collaborators (1990), Cernea (1992).

In the present paper there are presented the results regarding the morphological structure of cones and also the productivity and qualitative features at Romanian hops cultivars.

Material and method

During 2002-2004 there were studied at Cluj Napoca the morphological characteristics of the cones at six hops cultivar created at UASVM Cluj Napoca, from different groups of maturity: Napoca (medium early), Aroma (medium late), Alfa (medium late), Superalfa de Cluj (medium late), Transilvania (late) and Productiv (late).

At each cultivar, there were determined the morphological structure of the cone, the length and thickness of the rachis, and also the numbers of nodulations (heels) on rachis. Also, there was determined the content in alpha acids on ha.

Under the climatic aspect, the experimental years were hot and dry, less favorable for the production and hops quality.

Results and discussion

The results of the investigation regarding the morphological structure of the cones on the biological material studied are presented in table 1.

Table 1

Morphological structure of hops cone at six hops cultivars
(Cluj Napoca, 2003-2004)

Nr. crt.	Cultivar	Average weight of the cone (mg)		Average weight of the bracts (mg)			Average weight of bract		
		x	s%	x	% of the cone weight	s%	x	% of the cones weight	s%
1.	Napoca	271,4	21,7	219,2	80,8	16,1	52,2	19,2	25,8
2.	Aroma	213,8	16,5	192,0	89,8	17,8	21,8	10,2	14,7
3.	Transilvania	178,6	16,4	152,0	85,1	19,2	26,6	14,9	18,9
4.	Alfa	151,0	14,3	134,6	89,1	14,5	16,4	10,9	19,8
5.	Productiv	206,4	19,2	178,7	86,6	15,6	27,7	13,4	23,5
6.	Superalfa de Cluj	251,1	12,8	218,2	86,9	16,6	32,9	13,1	24,4

Both the average cone weight and the components weight have high values at Napoca, a medium late hops cultivar and Superalfa de Cluj, which is a medium late hops cultivar. At Napoca there was registered a superior value compared to other cultivars also regarding to the variability coefficient, which demonstrated the great variability within this cultivar.

Also it was noticed that later cultivars Transilvania and Productiv have average cones, and Alfa cultivar has simple cones.

The average weight of cones is between 151,0 mg at Alfa cultivar and 271,4 mg at Napoca. They are different because of the high values of over 200 mg at Aroma, Productiv and Superalfa de Cluj.

The elements of the cone also present high variations from a cultivar to another. The bracts weight is different between 134,6 and 219, 2 mg. With values of bracts higher than 200 mg, are Napoca and Superalfa de Cluj, while Alfa has the bracts weight of 134,6 mg.

The amplitude of the rachis weight variation from a cultivar to another is very high, between 16,4 and 52,2 mg. There were found values under 30 mg at four genotypes, especially Alfa and Aroma cultivars.

The average percent of participation of the two elements in the total cone weight has interesting results and differ from a cultivar to another. Of the cone weight, bracts represent 80,8-89,8 % and rachis owns 10,2-19,2%. They distinguish by a higher percentage of bracts, of over 85% of the total and so by a finer rachis (under 15%) at all the cultivars, except Napoca whose cones are brutish (19,2% rachis). It is observed that Aroma and Alfa have the cones with the finest rachis (10,2 and 10,9% of the cone weight).

In order to better illustrate several characteristics of the cone there were made observations and detailed determinations regarding the number of bracts in cone, length and thickness of the rachis and the number of heels on rachis, the results being centralized in tables 2 and three.

Table 2

The numbers of the bracts in cone at the hops cultivars (Cluj-Napoca 2002-2004)

Nr. crt.	Cultivar	Number of coverage bracts		Number of internal bracts		Number of total bracts		Report between internal bracts and coverage bracts
		x	$\pm S_x$	x	$\pm S_x$	x	$\pm S_x$	
1.	Napoca	22,5	1,5	46,6	3,1	69,1	4,2	2,07
2.	Aroma	21,4	1,4	59,2	3,7	80,6	4,8	2,77
3.	Transilvania	21,2	1,8	53,4	2,9	74,6	3,3	2,52
4.	Alfa	20,6	1,1	51,7	2,4	72,3	3,1	2,51
5.	Productiv	22,3	1,2	54,5	3,8	76,8	5,7	2,44
6.	Superalfa de Cluj	21,8	1,2	58,0	2,6	79,8	4,9	2,66

Table 3

The characteristics of the rachis at the hops cultivars (Cluj Napoca, 2002-2004)

Nr. crt.	Cultivar	Rachis length (mm)		Rachis thickness (mm)		Number of heels on rachis		Number of heels on 1 cm of rachis
		x	$\pm S_x$	x	$\pm S_x$	x	$\pm S_x$	
1.	Napoca	31,4	1,6	1,85	0,04	11,2	0,6	3,57
2.	Aroma	28,2	1,3	1,12	0,03	12,3	0,7	4,36
3.	Transilvania	26,8	2,1	1,31	0,06	11,6	0,3	4,33
4.	Alfa	22,1	1,4	1,11	0,03	11,6	0,4	5,25
5.	Productiv	27,6	2,2	1,32	0,07	11,7	0,8	4,24
6.	Superalfa de Cluj	28,1	1,5	1,35	0,04	11,9	0,5	4,23

According to the cone weight and the bracts weight (table 1) from the dates presented in table 2 it can be noticed that the total number of bracts is higher at the medium late cultivars Aroma and Superalfa de Cluj, of 80,6 and 79,8, resulted from the higher number of internal bracts (59,2 at Aroma and 58 at Superalfa de Cluj).

Between the hops cultivars studied great differences are noticed regarding the internal bracts number, with a value between 46,6 at Napoca and 59,2 bracts at Aroma, five cultivars having over 50 internal bracts.

The report between internal bracts and coverage bracts increases from the medium early cultivar Napoca (2,07) to medium late cultivar Aroma (2,77).

The length of the rachis varies between 22, 1-31,4 mm, higher values at Napoca, Aroma and Superalfa, and the thickness is between 1,08mm at Alfa and 1,85 mm at Napoca. The rachis is shorter and slimmer at Alfa. (table 3).

With a fine rachis, under 1,20 mm thickness, is remarked the cultivars Aroma, Transilvania, Productiv, Superalfa de Cluj, with 1,31-1,35 mm.

The number of nodulations (heels) on rachis is correlated in a positive way with bracts number on cm. The limits between it varies this character are between 11,2-12,3 heels. This character is expressed the best by the numbers of heels on unit of rachis. From this point of view, with high values are situated Alfa, Aroma, and Transilvania, with 4, 33-5,25 on heels on 1 cm rachis.

There are valuable the genotypes with high number of bracts, respectively with high percent of cones weight. Also the forms present interest with fine rachis, with great number of nodulations on length unit.

The morphological characteristics of the cone, along other quantitative characters are reflected upon the productive and qualitative characters of hops cultivars.

In table 4 are presented the productivity and qualitative characters of hops cultivars studied.

Table 4

The productivity and qualitative hops cultivars
(Cluj Napoca, 2002-2004)

Nr. crt.	Cultivar	Cones production		The content in alpha acids (%) of dry substances)	The production in alpha acids	
		kg/ha	%		kg/ha	%
1.	Napoca	1830	100,0	7,02	128,5	100,0
2.	Aroma	2815	153,8	6,15	173,1	134,7
3.	Transilvania	2802	153,1	6,98	195,6	152,2
4.	Alfa	1532	83,7	7,18	110,0	85,6
5.	Productiv	2994	163,6	7,14	213,8	166,4
6.	Superalfa de Cluj	2356	128,7	11,82	278,5	216,7

In the climatic conditions of the experimental years 2002-2004, warmer and dryer, the production of cones is situated between 1830-2994 kg/ha. The cultivars distinguished with high production are Productiv, Aroma, Transilvania and Superalfa de Cluj, which overdue Napoca cultivar with increase between 28,7-63,6%.

The experimental years influenced the content in alfa acids of cones, which was situated between 6,15-11,82%. That is why, the alpha acids production has values between 110 kg/ha at Alfa and 278,5 kg/ha at Superalfa de Cluj. The last one accomplish a production of alfa acids of two times higher than Napoca.

Conclusions

1. Hops cultivars studied are characterized by a great phenotypical variability of the cones characteristics.

2. Excepting Alfa cultivar, the other genotypes have high values of the cones weight, their number and bracts weight, the main components which define

the potential of production, Aroma and Superalfa de Cluj cultivars are highly different.

3. Because the high content in bitter substances, Superalfa de Cluj cultivar, even if it is inferior to Aroma, Transilvania and Productiv from the cones production, accomplish the highest production of alfa acids at the surface unit.

Bibliography

1. **Cernea S., Salontai Al., Muntean L.,** 1990, Cercetări privind elementele de productivitate la soiurile de hamei cultivate în România. Sesiunea de comunicări științifice, 18 octombrie, Inst. Agr. Cluj-Napoca

2. **Cernea S.,** 1992, Studiul colecției de germoplasmă de hamei (*Humulus Lupulus* L.) în vederea stabilirii genitorilor pentru procesul de ameliorare

3. **Salontai Al., Muntean L., Kapros O.,** 1978, Principalele însușiri morfologice, biologice și calitative ale soiurilor de hamei cultivate în România. Lucrările celui de al II-lea simpozion „Cultura hameiului în România”, Inst. Agr. Cluj-Napoca.