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Colour stability of the flowers in some modern rose varieties in Hungary

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Summary: A variety trial has been carried out to study the colour changing – colour stability of the flowers of some modern roses, especially of Hungarian varieties. 100 floribundas and polyanthas were observed. Colours of the petal surface were examined at three fenological stages of the flowers: at the bud, at the young open flowers and at the aged open flower stages. The colour difference was described in HLS standard. Our work shows that valuable Hungarian varieties can be found in both studied classes, but more floribundas bred in Hungary had good colour stability than polyanthas. The best Hungarian floribundas were 'Pest' and 'Reményik Sándor emléke', although 'Régen', 'Szent László emléke' and 'Szabó Dezső emléke' were quite good. The best Western-European floribunda rose was 'Perneille Poulsen'. Their colour stability was reliable in different situations. Colour changing of the two best varieties was almost unperceivable from the bud to the young petals and from the young to the aged petals. In the polyantha class there was only one perfect variety: the Czech 'Csl Cerveny Kriz'. The 'Fairy Damsel' was almost excellent as well. The best Hungarian polyanthas were 'Domokos Pál Péter emléke' and 'Savaria'.

Key words: rose, floribunda, polyantha, climbing, blooming, flowering, variety trial, Hungarian

Introduction

In Hungary, the Research Institute for Fruitgrowing and Ornamentals has been maintaining a rose garden since the 1960's. The rich collection of nearly 1.5 thousand varieties provides excellent opportunity for the evaluation of Hungarian and well known foreign rose varieties. Unlike the experiments by *Palai* et al. (2003), which concentrate on hybrid varieties and greenhouse productions, we wanted to place the floribunda and polyantha classes in focus.

The most impressive feature of the garden rose is the mass of the flowers. The good rose varieties can create solid, vivid patches of colour, white, yellow, pink, red, etc., or sometimes a multicoloured carpet. Therefore the quality of the flower colour is a very important part of the variety evaluation. There are publications, in witch the main task was to determine the exact colour(s) of the petals, for example *Zhenjang* et al. (2005). The main aim of their work was to specify the varieties as accurately as possible. Other works studied the environmental influences on the colour intensity, for example the effect of low light conditions and different sucrose levels (*Uddin* et al., 2001). In spite of the fact, that the petal colour is the most prominent feature of the rose flower, the exact colour itself does not determine the value of a variety, since it is a matter of taste. A golden yellow rose is not more valuable than a light yellow one. In the evaluation of the garden roses, colour stability seems to be even more important. Flower in any colour can be valuable, but the best roses must have good colour stability, without faded or spotted petals. It is especially true in public parks, because dead-heading cannot always be carried out in such locations. In view of these considerations, we have decided to study the colour stability of some new Hungarian varieties and foreign roses in our rose garden.

Our studies were carried out in two stages, in 2002 and 2003. In stage I, the blooming intensity and in stage II, the discolouring of the flowers was studied. In 2003, the petal colour of the varieties was studied: it was recorded how intensive the fading and the changing of petal colour was.

Beyond the examined characters of the colours there are a number of features that are under strong influence of fashion, for example scent, shape and general colour of the flowers. These subjective characters have not been studied.

Materials and methods

Varieties

This variety evaluation was carried out in Budapest, at the Budatétény Rose Garden, in 2003. The following varieties were studied: Hungarian bred roses: 35 floribundas and 18 polyanthas and as control, Western-European roses from our collection: 35 floribundas and 12 polyanthas. The names and

classifications of rose varieties are according to the American Rose Society "ARS approved exhibition name" (*Cairns* et al., 2000), Hungarian lists of varieties (*Rátkai,* 2001), and breeders' lists of the Hungarian variety candidates (*Márk,* 2004). The the assessed rose varieties are the following in alphabetical order (po – polyantha, fl – floribunda):

Ady Endre emléke (fl Márk –) – carmine red, , Apor Péter emléke (po Márk –) – red, Árpád (po Márk 2002) – salmon red, Athos (fl Laperriere 1965) – orange red, Attila (fl Márk –) – dark red, Barbecue (fl Dickson 1961) – red, Báthory István emléke (fl Márk –) – bright red, Beauty of New South Wales (po Knight 1931) – bright pink – white, Bethlen Gábor emléke (fl Márk 1997) – dark pink, Bodor Péter emléke (po Márk 1998) – lighr pink, Border King (po deRuiter 1952) – light red, Borsod (fl Márk –) – bright red, Brillant Star (fl Watkins Roses 1965) – bright red – yellow, Chanalle (fl McGredy 1959) – pink shades, Chic Parisien (fl Delbard-Chabert 1956) – soft pink, Colisée (fl Gaujard 1965) – reddish pink, Csinszka (po Márk 2002) – purple pink, Csl Cerveny Kriz (po Böhm 1937) – carmine, Déryné (fl Márk –) – soft pink, Déva (po Márk –) – red, Diabolo (fl Gaujard 1958) – dark salmon, Dick Koster Fulgens (po Koster 1940) – light red, Domokos János emléke (fl Márk 1997) – golden yellow, Domokos Pál Péter emléke (po Márk 1998) – salmon red, Dsida Jenő emléke (po Márk 1996) – yellow-pink-red, Elsbeth Meyer (po Vogel 1940) – dark red, Erzsébet királyné emléke (fl Márk –) – soft pink, Fairy Damsel (po Harkness 1982) – soft pink, Fresco (fl deRuiter 1968) – orange – yellow, Garden Princess (fl Leenders 1961) – yellow, Gelence (fl Márk –) – carmine, Gold Badge (fl Paolino 1978) – lemon yellow, Golden Perfume (fl Leenders 1959) – orange – gold, Golden Slippers (fl Von Abrams 1961) – yellow – red, Gül Baba (fl Márk 2000) – bright red, Gustav Strobel emléke (po Márk –) – bright pink, Happy (po deRuiter 1954) – carmin red, Happy Event (fl Dickson 1964) – yellow – pink, Háry János (po Márk –) – bright pink, Hollandia (po deRuiter 1958) – dark red, Hungaria (fl Müller 1965) – light red, Ilma (fl Márk –) – dark red, Ingrid Stenzig (po Hassefras Bros. 1951) – pink, Insel Mainau (fl Kordes 1959) – carmine, János vitéz (fl Márk –) – salmon red, Jókai Mór emléke (po Márk –) – salmon – red, Kovászna (fl Márk –) – salmon red, Kund Abigél (fl Márk –) – purple red, La Sevillana (fl Meilland 1978) – bright red, La Voulzie (fl Robichon 1953) – dark red, Laborfalvi Róza emléke (fl Márk –) – dark pink, Lágymányos (fl Márk 2000) – light red, Leila (fl Márk –) – light pink, Lilli Marleen (fl Kordes 1959) – medium red, Liu (fl Márk –) – white – carmine, Max Holder (fl Márk 2000) – pink, Mikszáth Kálmán emléke (po Márk –) – yellow – pink, Millecentenárium'96 (fl Márk 1996) – soft pink, Minuette (fl Lammerts 1969) – white – red, Montijo (fl Dot 1954) – carmine, Mothers'day (po Grootendorst 1949) – dark red, Mrs.Joseph Hiess (po Shepherd 1943) – pink, Munkács (fl Márk –) – bright red, Nagyvárad (po Márk –) – light red, New Daily Mail (fl Tantau 1972) – dark red, Nina Weibul (fl Poulsen 1962) – dark red, Nouvelle Europe (fl Gaujard 1964) – orange red, Okályi Iván emléke (fl Márk 1997) – salmon red, Orange Triumph Improved (po Cant 1960) – orange red, Örség (fl Márk –) – red – pink, Pernille Poulsen (fl Poulsen 1965) – light pink, Pest (fl Márk 1993) – dark red, Picasso (fl McGredy 1971) – red – white, Poppy Flash (fl Meilland 1971) – orange red, Ráskai Lea (fl Márk 2002) – light yellow, Régen (fl Márk 2000) – light pink, Rekordblüher (fl Tantau 1965) – rose pink, Reményik Sándor emléke (fl Márk –) – bright pink, Rosali (fl Tantau 1983) – medium pink, Sanktflorian (fl Meilland 1971) – medium red, Savaria (po Márk –) – carmine red, Scania (fl deRuiter 1965) – dark red, Sunsprite (fl Kordes 1977) – golden yelow, Szabó Dezső emléke (fl Márk 1998) – bright red, Szárazajta (fl Márk –) – bright red, Szendrey Júlia emléke (po Márk –) – light – medium pink, Szent Gellért (fl Márk 1998) – soft pink, Szent László (fl Márk 2002) – carmine, Szent Margit (fl Márk 1997) – white, Táncsics Mihály emléke (po Márk –) – bright red, Tantau's Surprise (fl Tantau 1951) – bright red, Taranga (fl Tantau 1982) – medium red, Tihany (po Márk –) – orange – pink – red, Tornado (fl Kordes 1973) – orange red, Vak Bottyán emléke (fl Márk –) – dark pink, Verecke (po Márk –) – pink shades, Violet Carson (fl McGredy 1964) – pink – silver, Vörössipkások emléke (fl Márk 1998) – bright red, Zágon (fl Márk –) – salmon pink, Zirc (po Márk –) – pink.

Site of experiments

The experimental garden is situated in the southern part of Budapest, in Budatétény. It is located on the margin of the north-western region of the Hungarian Great Plain, the most characteristic geographical part of the country. The typical climate of the Great Plain is continental, characterised by cold winters, frosty springs, hot and dry summers. The rainiest months are May and June. The meteorological and geographical data of Budatétény are the following: 102-110 metres above sea level, the soil is rendzina; the relief type is dissected plain. The mean January temperature is -2- -1 °C, the mean July temperature is 18-20 °C. Mean annual absolute minimum temperature: -15-16°C, mean annual absolute maximum temperature: 33°C. The average annual precipitation is 600 mm. (*Pécsi*, 1989)

Meteorological condition

The weather in the two years of the experiment was almost "perfect" for evaluating dry-climate tolerant varieties, because the temperature and the precipitation were critical in that summer.

In 2003, the spring and the summer were extremely hot, and arid, an unusual warm wind came from Africa. In addition, due to the wind, the surface of the soil was continuously dry, and atmospheric drought could be observed: the air was very dry throughout the year. See *Figure 1* on the weather of the Rosarium in 2003.

Care of plants

The varieties were planted in rows into beds, in 1993-1995, with 8–10 stocks in each row. During the experiment,

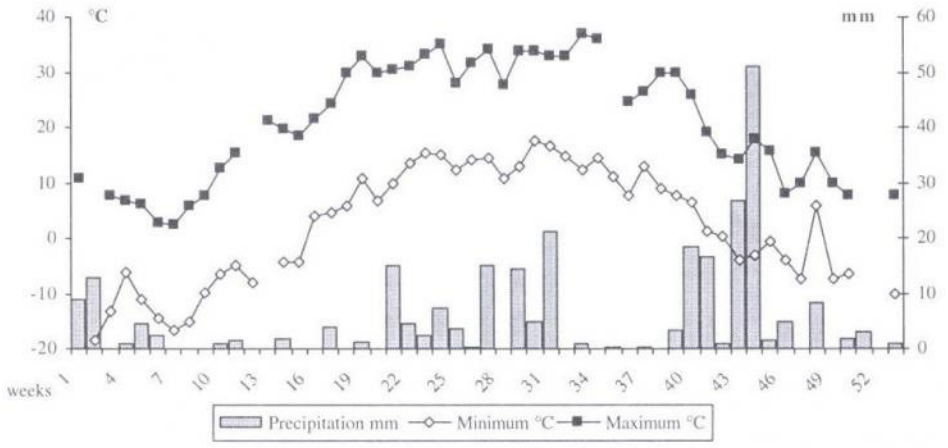

Figure 1 Weekly maximum and minimum temperature and precipitation in the year 2003 according to the metrological station at the Rose Garden.

the rose plantation received only the essential maintenance, for example no irrigation was deployed in summer. The garden received as much pruning, weeding and plant-protection spraying as Hungarian parks usually do.

Determination of the discolouring

The question, which petal colour is the most decorative, is a matter of taste, though a fading flower is disadvantageous. Nonetheless, sometimes, a very strong shift in flower colour can be attractive. Masquerade (floribunda, Boerner, 1949) – a well-known old variety – is a good example of it.

The colours of the flowers were measured between 2 and 9 July 2003. They were specified according to "Pantone Colour Formula Guide 2002–2003 Printer Edition" colour cards. Although this colour-set is not supposed to be used in botany, it has proved to be more useful, than the RHS Colour Chart (1986), because the physical parameters of each colour of the card are determined, and can be used. RHS Colour chart still needs identifying (H: *Voss*, 1992)

First, the Pantone colour codes were recorded with comparing the colour cards to the petals in a shaded but sunny place. After that, the colour data were converted to the standard HLS (hue-luminosity-saturation) system by means of Corel! Photo-Paint 9 (version number 9.397). It gives exact HLS values for all Pantone colours. HLS has proved to be a suitable colour system, because its parameters describe the colours in the similar way, to the human colour perception. (*Figure 2*).

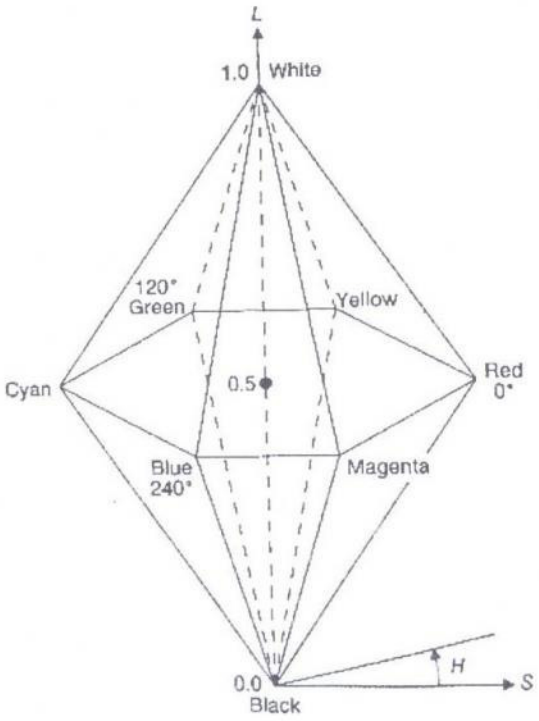

Figure 2. Section view of the HLS colour model (from J. BRADLEY online)

The 3 elements of the HLS model are the following:
HUE in degree from 0 to 359, where 0 is pure red,
LUMINOSITY in percent, where 0 = black, 50 = bright colour, 100 = white,
SATURATION in percent, where 0 = grey, 100 = brightest.

The HLS model can be converted to any other standard colour systems, for example to RGB, used in monitors, or to CYMK used in printing processes, and to the platform free L*a*b code used colour analysers (*Uddin* et al., 2001).

Originally the flowers were described with 6 colours, but 3 of them are sufficient to determine the discolouring, which are the followings:

1: the petal colour of the opening bud, when the colour of the petals can be seen;
2: the surface colour of the petal of the young, partly-open flower;
3: the surface colour of the aged petal, when the flower is the widest in diameter.

To describe the colour of the petal, there was no sense in splitting the petals into mono-colour segments, which is essential in variety recognition (*Zhenjiang* et al., 2005). In each flower the typical colour was identified by determining the overall colour of the flower. The exact location of the determinant colour depends on the flower type: in the single form it was in the centre of the petal, but in the full or double flower the determining colour was found at the edge of the petals. The other parts of the petals are invisible.

To specify the degree of colour change, in the course of flower is ageing, two sets of values were calculated.

1. Change of colour, from the opening bud to the matured flower, thorough young flower stage. Colour shift was calculated according to the following method: Change of hue $\Delta H_1 = |H_1-H_2| + |H_2-H_3|$, change of luminosity $\Delta L_1 = |L_1-L_2| + |L_2-L_3|$, change of saturation $\Delta S_1 = |S_1-S_2| + |S_2-S_3|$, where $_1$ = bud stage, $_2$ = young and $_3$ = matured flower stage. Since the variances of the three parameters are different and not to be directly compared – for example the highest possible change is 100 at luminosity and at saturation, but 180 at hue

– the final results are expressed in the percent of the mean value of ΔH_1, ΔL_1 and ΔS_1.

The following example describes the application of the method: The petal colour in the opening bud is dark middle red (hue = 1°), the young flower is fiery red (h=7°) and the aged flower is a little more purple (h=353° or -7°). The hue change (ÄH1) of that flower is |1-7|+|7—7|= 6+14 =20 (°). If the average of the change is 25°, it means, that the change of the hue from the bud, to the aged flower is 80% of the average colour hue shift.

2. Change of colour from the young flower to the mature flower stage. The method of calculating the colour shift is the following: Change of hue $\Delta H_2 = |H_2\text{-}H_3|$, change of luminosity $\Delta L_2 = |L_2\text{-}L_3|$, change of saturation $\Delta S_2 = |S_2\text{-}S3|$, where 2 = young and 3 = matured flower stage. The results are expressed in the percentage of the mean of ΔH_2, ΔL_2 and ΔS_2.

It is to be noted that the bud colour corresponds to the back of the petals, because when the bud is opening, only the back of the petal can be seen through the sepals. In the case of certain rose varieties the colour of the petal surface does not express the general colour of the flower, for example when the flower is full or rosette shaped. Here, the back of the curved petals may cover their upper side and the two colours blend into a colour that looks like the colour of the flower. In this case the general colour of the flower was measured. White roses, such as 'Szent Margit emléke' or 'Iceberg' were not studied.

Results and Discussion

In the present study well visible differences in the colour stability were studied in rose varieties.

As a first well definable, trait the colour stability of flowers was estimated. *Table 1* summarizes the results of observations on the colour change, (from the bud stage of the flower), whereas *Table 2* shows data on the colour change from the partly-open flower stage. Only the most remarkable varieties are shown, the most colourfast roses and the varieties, with the strongest colour change.

According to *Table 1*, only one non-fading variety was found, where the colour of the bud, i.e. young and aged petals are the same. This was the cultivar "Reményik Sándor emléke", a Hungarian floribunda cultivar. The discolouring of the variety 'Pest' was also very slight, its saturation and lightness shown only a little change. Remarkably, the way of change (lightening or darkening) cannot be specified because during the opening process the colour can first become darker, then later on lighter or in the case of the yellow colour, more or less yellow, initially, and more or less purple afterwards. While discolouring of 'Dick Koster Fulgens' was a result of the colour hue shifting, the flower of 'Border King' became duller. The petals of 'Régen' changed their lightness, although their colour hue and saturation remained more or less constant. The cultivars 'Minuette', 'Liu', 'Dsida Jenő emléke' and 'Colissée' are colourful roses, where the strong colour shift is the source of their attractiveness. For example

Table 1 Discolouring of flowers (from bud to matured flower): The ten varieties, which have the weakest, and the strongest colour change. The data are in percent of the average change.

Variety	Class	Hue ΔH_1	Lightness ΔL_1	Saturation ΔS_1	Average of ΔH_1, ΔL_1, ΔS_1
Reményik Sándor emléke	fl	0%	0%	0%	**0%**
Pest	fl	6%	21%	28%	**18%**
Csl Cerveny Kríz	po	48%	25%	11%	**28%**
Régen	fl	6%	87%	13%	**35%**
Pernille Poulsen	fl	29%	46%	39%	**38%**
Dick Koster Fulgens	po	92%	21%	15%	**43%**
Kund Abigél	fl	70%	53%	11%	**44%**
Fairy Damsel	po	76%	37%	22%	**45%**
Border King	po	41%	21%	76%	**46%**
Csinszka	po	25%	247%	169%	**146%**
Borsod	po	76%	133%	243%	**149%**
Vörössipkások emléke	fl	115%	179%	195%	**161%**
Mrs.Joseph Hiess	fl	356%	37%	104%	**165%**
Ady Endre emléke	fl	229%	114%	160%	**167%**
Leila	fl	325%	78%	295%	**231%**
Colisée	fl	38%	758%	98%	**295%**
Dsida Jenő emléke	po	678%	247%	48%	**323%**
Liu	fl	509%	256%	241%	**334%**
Minuette	fl	617%	252%	160%	**342%**

Table 2 Discolouring of flowers (from young to matured flower): The ten varieties, which have the weakest, and the strongest colour change. The data are in percent of the average change.

Variety	Class	Hue ΔH_2	Lightness ΔL_2	Saturation ΔS_2	Average of ΔH_2, ΔL_2, ΔS_2
Fairy Damsel	po	0%	0%	0%	**0%**
Pest	fl	0%	0%	0%	**0%**
Reményik Sándor emléke	fl	0%	0%	0%	**0%**
Savaria	po	0%	0%	0%	**0%**
Szent László emléke	fl	0%	0%	0%	**0%**
Csl Cerveny Kríz	po	22%	14%	0%	**12%**
Régen	fl	0%	47%	0%	**16%**
Domokos Pál Péter emléke	fl	29%	5%	17%	**17%**
Tornado	fl	7%	43%	39%	**28%**
Lágymányos	fl	253%	85%	11%	**120%**
Ady Endre emléke	fl	260%	47%	122%	**143%**
Mrs. Joseph Hies	fl	245%	0%	188%	**145%**
Munkács	fl	375%	76%	105%	**147%**
Happy Event	fl	188%	142%	299%	**210%**
Leila	fl	36%	152%	687%	**292%**
Dsida Jenő emléke	po	679%	228%	111%	**339%**
Minuette	fl	765%	398%	200%	**454%**
Colisée	fl	14%	1418%	72%	**501%**
Liu	fl	1090%	417%	200%	**569%**

Table 3 Discolouring of flowers (from bud to matured flower, average of the hue and the luminosity): The varieties, which have the weakest, and the strongest colour shift (lower than 50% or higher than 150% of the average change).

Floribunda:	Average of ΔH_1 and ΔL_1	Polyantha:	Average of ΔH_1 and ΔL_1
Reményik Sándor emléke	0%	Beauty of New South Wells	22%
Pest	13%	**Border King**	31%
Pernille Poulsen	37%	**Csl Cerveny Kriz**	36%
Szabó Dezső emléke	40%	**Szendrey Júlia emléke**	45%
Barbecue	42%	**Savaria**	46%
Poppy Flash	47%	**Domokos Pál Péter emléke**	48%
Régen	47%		
Nagyvárad	48%		
Lilli Marleen	50%		
Ady Endre emléke	172%	**Tihany**	171%
Leila	201%	**Mrs.Joseph Hiess**	197%
Liu	383%	**Dsida Jenő emléke**	463%
Colisée	398%		
Minuette	435%		

Table 4 Discolouring of flowers (from young to matured flower, average of the hue and the luminosity): The varieties, which have the weakest, and the strongest colour shift (lower than 35% and higher than 150% of the average change).

Floribunda:	Average of ΔH_2 and ΔL_2	Polyantha:	Average of ΔH_2 and ΔL_2
Reményik Sándor emléke	0%	**Savaria**	0%
Pest	0%	**Fairy Damsel**	0%
Szent László	0%	**Domokos Pál Péter emléke**	17%
Báthory István emléke	13%	**Csl Cerveny Kriz**	18%
Régen	24%	**Border King**	34%
Insel Mainau	24%		
Nagyvárad	25%		
Borsod	26%		
Szabó Dezső emléke	35%		
Ady Endre emléke	154%	**Tihany**	226%
Happy Event	165%	**Dsida Jenő emléke**	453%
Garden Princess	169%		
Minuette	582%		
Colisée	716%		
Liu	754%		

'Dsida Jenő emléke', a Hungarian polyantha is butter-yellow at first, then it becomes soft-pink after opening, and then the petals gradually become dark salmon-red with white edge, and eventually almost white.

If the bud stage is omitted (*Table 2*), a lot of varieties can be distinguished with good non-fading flowers. 'Fairy Damsel', 'Savaria', 'Szent László emléke' and 'Pest' proved to be practically non-fading, in addition to 'Reményik Sándor emléke'.

The three elements (hue, luminosity, saturation) cannot be measured with equal accuracy. It is hard to specify, if a very dark, or very light flower becomes duller or not. To avoid this type of error in *Table 3* and *Table 4*) only the average of H and L components of the colour shift are shown, where the saturation is omitted.

According to *Tables 3* and *4*, if only hue and saturation are taken into consideration, the cvs. 'Reményik Sándor emléke' and Pest' were the best non-fading floribundas. Both of them are Hungarian bred varieties. With regards to the colour of the bud, 'Perneille Poulsen was the least discolouring non Hungarian variety. If the bud stage is omitted, a lot of additional floribundas can be found with little colour fading, e.g.: the Hungarian varieties 'Szent László', 'Báthory István emléke', 'Régen', and the best foreign rose 'Insel Mainau'. In the polyantha class fewer varieties were non-fading or colourful. According to *Table 3,* Hungarian polyanthas have weaker colour stability than cvs. 'Beauty of New South Wells', 'Border King' and 'Csl Cerveny Kriz'. All polyantha varieties have a colour shifts to some degree. According to *Table 4*, the best Hungarian polyanthas were 'Savaria' and 'Domokos Pál Péter emléke', while 'Fairy Damsel' and 'Csl Cerveny Kriz' were the least colour-fading roses from Western Europe. 'Dsida Jenő emléke', 'Colisée' and 'Minuette' were the most colourful varieties.

Based on our observations it could be established that only a few varieties show strong colour stability throughout the whole life of their flowers. Most roses have constant colours only in the phenophase when their flowers are partly open and open. On the other hand some varieties have such a wide colour change, which is considered attractive and colourful. The HLS model of the colour space has revealed, that not only the light (or luminosity) of the flower can shift but also the hue is changeable in most of the cases. The three "dimensions" of the colour are independent, and they can shift also independently.

Conclusion

The rose varieties have been evaluated according to four characteristics: colour stability from the bud stage and from partly opened flower stage, with and without the saturation unit of the HLS colour model. Only those varieties were declared to be excellent in the colour stability of the flowers that showed good results in more than one evaluation. By summarizing our observations in a list of all varieties the best rose varieties could be selected (*Table 5*). "X" means that the variety was one of the best four in each observation. Because by the practice the most colour-stable roses are most desirable, colourful varieties with a strong and characteristic colour change have been omitted from the list of the best roses.

The list shows that valuable Hungarian varieties can be found in both studied classes, but more Hungarian bred

Table 5 The roses with the highest colour stability of their flowers in our variety trial in 20003 at Budatétény.
Meanings of the header are below the table.

variety name, breeder, year	*1*	*2*	*3*	*4*
floribundas				
Báthory István emléke (Márk, -)				x
Pest (Márk, 1993)	x	x	x	x
Perneille Poulsen (Poulsen, 1965)	x		x	
Régen (MÁrk, 2000)	x	x		
Reményik Sándor emléke (Márk, -)	x	x	x	x
Szent László emléke (Márk, 2002)		x		x
Szabó Dezső emléke (Márk, 19989)			x	x
polyanthas				
Beauty of New south Wells (Knight, 1931)			x	
Border King (deRuiter, 1952)	x		x	
Csl Cerveny Kriz (Böhm, 1937)	x	x	x	x
Domokos Pál Péter emléke (Márk, 1998)		x		x
Dick Koster Fulgens (Koster, 1940)	x			
Fairy Damsel (Harkness, 1982)	x	x		x
Szendrey Júlia emléke (Márk, -)			x	
Savaria (Márk, -)		x		x

Meaning of the header of Table 5:
1 – Best non-fading varieties (bud to matured flower), according to *Table 2* (4 varieties)
2 – Best non-fading varieties (young to matured flower), according to *Table 3* (4 varieties)
3 – Best non-fading varieties; hue, luminosity only (bud to matured flower), according to *Table 4* (4 varieties)
4 – Best non-fading varieties; hue, luminosity only (young to matured flower), according to Table 5 (4 varieties)

floribundas had a better colour stability than the polyanthas. The best Hungarian floribundas were 'Pest' and 'Reményik Sándor emléke', although 'Régen', 'Szent László emléke' and 'Szabó Dezső emléke' were quite good. The best Western-European floribunda rose was 'Perneille Poulsen'. Their colour stability was reliable in different situations. Changing of the colour of the two best varieties was almost unperceivable from the bud to the young petals and from the young to the aged petals. 6 out of the 7 good varieties were bred in Hungary that means the floribunda roses – especially red varieties – have a better colour stability than many well known Western European roses. In the polyantha class there was only one perfect variety: the Czech 'Csl Cerveny Kriz'. The 'Fairy Damsel' was excellent in 3 evaluations out of 4. The best Hungarian polyanthas were 'Domokos Pál Péter emléke' and 'Savaria'. In general, polyanthas have weaker colour stability, because the hardiness and compactness of that class is more important, than the flower quality. It is true even the Hungarian polyanthas, although 'Domokos Pál Péter emléke' has really very good stability. According to the evaluations, among the Hungarian roses 'Reményik Sándor emléke' has the strongest colour stability, this variety candidate is bred by Gergely Márk.

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