

Tarenaya Cultivars: Genome Size and Genetic Diversity

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Introduction

The spider flower, *Tarenaya hassleriana* (syn. *Cleome spinosa*), belongs to the family *Cleomaceae*, that originates in South America, and is used as ornamental plant (Fig.1). Cultivar series were bred on a small scale and showed low morphological diversity. The used gene pool is mostly unknown. Therefore, in 2021, market-dominating *Tarenaya* cultivars were tested in a field trial in Dresden, Germany, for consumer properties as flower performance, plant height and durability. In addition, DNA content and genetic variability of the cultivars were determined to support further breeding progress.

Results

Tab. 1 Mean 2C values, plant height, and mean scores field performance of the *Tarenaya* genotypes.

Overall information		Flow cytometry			Morphological traits			
Cultivar	Code	n	Mean 2C value (pg) ± SD	Ploidy level ¹	Plant height (cm)	Flowering performance ± SD	Overall impression ± SD	
					Week 25	Week 37	Mean scores (n = 10)	
'Araña Rose'	333	6	0.96±0.02	3x	45	95	8.6±0.70	7.9±0.88
'Araña Rose'	334	6	0.96±0.02	3x	48	102	8.6±0.70	7.9±0.88
'Araña Violeta'	335	6	0.92±0.02	3x	54	107	8.4±0.84	7.7±1.06
'Araña Violeta'	336	6	0.96±0.01	3x	50	100	8.2±1.87	7.8±1.03
'Clio Magenta'	341	6	0.94±0.02	3x	47	91	8.3±0.95	7.6±1.26
'Clio Pink Lady'	339	6	1.01±0.02	3x	41	96	7.8±1.40	7.5±1.18
'Kelly Rose'	342	6	0.94±0.04	3x	47	90	7.9±1.52	7.5±1.35
'Kleio Lilac'	344	6	0.95±0.04	3x	49	87	8.3±0.82	7.6±1.26
'Kleio Pink Blush'	343	6	1.00±0.02	3x	41	93	7.9±0.99	7.8±1.03
'Señorita Blanca'	345	6	0.67±0.02	2x	43	102	8.5±0.85	8.0±0.82
'Señorita Carolina'	346	6	0.66±0.01	2x	49	101	8.5±0.85	8.1±0.88
'Señorita Rosalita'	347	6	0.64±0.01	2x	46	102	8.1±2.23	7.7±1.42
'Helen Campell'	324	6	0.67±0.03	2x	75	115	6.6±3.03	6.1±1.66
'Helen Campell'	325	6	0.66±0.01	2x	89	143	6.6±2.88	6.2±1.62
'Kirschkönigin'	326	6	0.67±0.01	2x	75	145	6.3±2.87	6.2±1.87
'Queen Rose'	327	6	0.66±0.01	2x	85	135	6.5±2.68	6.3±1.70
'Violettkönigin'	332	3	0.65±0.02	2x	85	135	6.6±2.50	6.4±1.78
'Queen Violet'	328	6	0.65±0.01	2x	88	150	6.1±2.96	6.1±1.79
'Sparkler Blush'	329	6	0.66±0.01	2x	50	100	6.6±2.91	6.6±1.78
'Sparkler Lavender'	330	6	0.67±0.01	2x	53	123	6.3±3.09	6.4±1.90
'Sparkler Rose'	331	6	0.67±0.02	2x	47	95	6.3±2.67	6.5±1.84
<i>T. boliviensis</i>	70005	6	0.92±0.02	n.d.	n.d.	n.d.	n.d.	n.d.

n = number of biological replications analysed per genotype; ¹ Compared to 1C value = 0.307 pg for *Cleome* = *Tarenaya hassleriana* (Johnston et al., 2005); n.d. = not determined.

References

Johnston, J.S., Pepper, A.E., Hall, A.E., Chen, Z.J., Hodnett, G., Drabek, J., Lopez, R., and Price, H.J. (2005). Evolution of genome size in Brassicaceae. *Ann. Bot.* 95, 229-235

Materials & Methods

- Ten vegetatively and seven seed-propagated *Tarenaya* cultivars (Tab. 1,) provided by eight companies, were used. Also *T. boliviensis* was included in the study.
- Plant height was measured in week 25 and 37 as an average value in each plot. Scores from 1 to 9 (poor to very good) were awarded for the traits flowering performance and overall impression from week 21 until 39 every two weeks (n = 10).
- Total DNA was isolated for RAPD/dp-RAPD analysis. Clear strong bands were recorded in a 1/0 matrix and used for distance estimation. *Raphanus* was used as outgroup.
- By flow cytometry, three biological replications of fully developed leaves and petals per genotype were analysed with the internal standard tomato 'Stupické' (2C value = 1.96 pg).



Fig. 1 'Sparkler Blush'

Results

- Seed-propagated cultivars were taller than the vegetatively propagated varieties, but tended to lodging (Tab. 1).
- Vegetatively propagated cultivars showed a good flowering performance even in September, while seed-propagated cultivars declined significantly.
- 'Señorita' and 'Araña' series made the best overall impression, whereas 'Helen Campell' received the lowest rating (Tab. 1).
- Mean 2C values showed two main groups.
- Group 1 includes all generatively and three vegetatively propagated cultivars (0.64 pg to 0.67 pg) (Tab. 1).
- Group 2 consists of *T. boliviensis* and seven vegetatively propagated cultivars (0.92 pg to 1.01 pg) (Tab. 1).
- 168 individual bands from RAPD/ dpRAPD analyses allowed clear distinction between *T. boliviensis* and the cultivars as well as between the groups of vegetatively and seed-propagated cultivars (Fig. 2).
- Genetic variation within the cultivar groups was clearly reduced (Fig. 2).

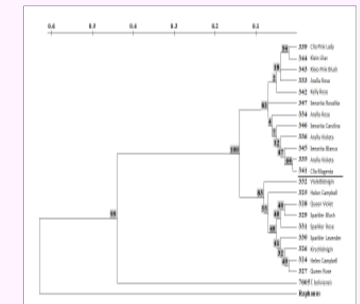


Fig. 2 Distance analysis of *Tarenaya* cultivars using the UPGMA method.

Conclusions and perspectives

- In the field, vegetatively propagated cultivars are superior to seed-propagated cultivars.
- Regarding the 2C values, a clear distinction was found between a diploid group comprising all seed-propagated cultivars and the 'Señorita' series and a putative triploid group. Tetraploidy was not found in the cultivars.
- Phenotypic similarity of the cultivars and hardly reduced genetic variation were confirmed.
- It was not possible to assign the varieties to their series or breeding companies.
- Further breeding efforts are necessary to develop *Tarenaya* cultivars with new traits. Whether hybridization between genotypes of different basic chromosome number and ploidy level are successful is unknown and requires further research.