

# Paula Poinsettia (*Euphorbia pulcherrima* Willd. ex Klotzsch) indoor variety

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## ABSTRACT

**Objective:** To evaluate the behavior of the Paula poinsettia variety (*Euphorbia pulcherrima* Willd. ex Klotzsch) and to describe its characteristics, based on the guidelines established by the International Union for the Protection of New Varieties of Plants (UPOV).

**Design/Methodology/Approach:** The genetic improvement included hybridization and selection techniques. To promote compaction and greater branching, it was grafted on a commercial variety. The cuttings obtained gave rise to the Paula variety (*Euphorbia pulcherrima* Willd. ex Klotzsch), which was described in 2020, based on the Guidelines for the Conduct of Tests for Distinctness, Uniformity and Stability of the International Union for the Protection of New Varieties of Plants. A completely randomized experimental design with 10 replications was used. Vegetative and bract characteristics were recorded and an analysis of variance was applied, as well as a Tukey's mean comparison test ( $P \leq 0.05$ ).

**Results:** The Paula variety is medium-sized and has a wide breadth and medium branching. It is pale green in the middle third of the stem. It has oval-shaped, long, and broad leaves of the same medium-intensity color, and a wedge-shaped base. It has a long petiole with a pale green upper side. This variety also has many elliptical red bracts of medium length and narrow width. Compared to other INIFAP varieties, the vegetative and bract characteristics of Paula presented statistical differences.

**Study Limitations/Implications:** The commercial production of poinsettia is carried out through asexual propagation. The mother plant is kept in a vegetative state, through comprehensive and intensive management, preventing its flowering and obtaining a continuum of propagation material.

**Findings/Conclusions:** Paula has an intermediate cycle, with quality and competitive size, branching, and color of the bract (red). It can satisfy the taste and preference of consumers in the domestic and even foreign markets.

**Keywords:** Poinsettia, genotype, graft, clone, bract.

**Citation:** García-Pérez, F., Canul-Ku, J., Barrios-Gómez, E. J., Portas-Fernández, B., & Rangel-Estrada, S. E. (2022). Paula Poinsettia (*Euphorbia pulcherrima* Willd. ex Klotzsch) indoor variety. *Agro Productividad*. <https://doi.org/10.32854/agrop.v15i11.2247>

**Academic Editors:** Jorge Cadena Iñiguez and Libia Iris Trejo Téllez

**Received:** April 07, 2022.

**Accepted:** November 13, 2022.

**Published on-line:** December 22, 2022.

*Agro Productividad*, 15(11). November, 2022. pp: 177-182.

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## INTRODUCTION

In Mexico, 16,268,524 finished poinsettia plants — from 30 varieties developed abroad— were produced in 2020. Ninety percent of the plants has red bracts and the remaining percentage is made up of yellow, pink, white, striped, and marbled tones. In Mexico City, Jalisco, Michoacán, the State of Mexico,



Morelos, Oaxaca, and Puebla, 240.6 hectares are used to grow poinsettias. Morelos was the main producer with 6,549,818 plants: approximately 40.3% of the national production (SADER, 2020).

*E. pulcherrima* is a tropical Euphorbiaceae native to Mexico (Canul *et al.*, 2013). However, the 30+ commercial varieties that are grown in the country have been developed abroad (SADER, 2020). This situation has the following consequences: 1) technological dependency; 2) right payment for the use of the variety, included in the cost of the cutting; 3) capital flight; 4) economic losses, resulting from pigmentation outside the commercial period; and 5) restrictions to the importation of vegetative material of new varieties (García-Pérez *et al.*, 2020).

In order to lessen the aforementioned consequences, the Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP), started in 2010 the Programa de Mejoramiento Genético de Nochebuena, at its Campo Experimental Zacatepec, located in Morelos, (Canul *et al.*, 2017a). To establish a broad genetic base—an essential requirement in any genetic improvement program—, germplasm (seeds and twigs) was collected in 10 Mexican states (Canul *et al.*, 2013). Their description was based on the morphological characteristics of their stem, leaf, bract, and plant (Canul *et al.*, 2014), applying the graphic handbook for variety description of poinsettia (Mejía *et al.*, 2006) and the Guidelines for the Conduct of Tests for Distinctness, Uniformity and Stability of plant organisms (UPOV, 2008). Subsequently, the scientific bases for hybridization were established (Canul-Ku *et al.*, 2015), which allowed the crossing of parents with contrasting characteristics. The outstanding genotypes were evaluated in the C. E. Zacatepec (Canul-Ku *et al.*, 2017a) and in Tetela del Monte, Cuernavaca, Morelos (Canul-Ku *et al.*, 2017b). Grafting techniques were defined to support the genetic improvement of poinsettia (García-Pérez *et al.*, 2017), in order to promote compaction and a greater plant branching (García-Pérez *et al.*, 2019, 2020).

After a 10-year research about the *E. pulcherrima* genetic improvement, one of the results obtained is the varietal description of the material called Paula, as well as its evaluation and comparison with other varieties. Given the quality and competitiveness of its size, branching, and color of the bract (red), its cultivation and commercialization at national and international level are a viable option, which benefits different links in the poinsettia production chain.

## MATERIALS AND METHODS

Table 1 shows the process used to obtain the indoor variety of the Paula poinsettia. Manual crossing between the OAX10 and MORPR13 parents was performed in 2013. The F<sub>1</sub> progeny were evaluated in 2014 and the best plants were selected based on the poinsettia ideotype established by Canul-Ku *et al.* (2017a). From 2014 to 2017, in the C. E. Zacatepec (18° 39' 16" N, 99° 11' 54" W, altitude 910 m.a.s.l.), the number of plants was increased by vegetative propagation, during four selection cycles, applying the poinsettia production technological package (García *et al.*, 2017).

**Table 1.** Process used to obtain the Paula poinsettia indoor variety.

Year	Generation	Process
2013	OAX10 X MORPR13 ↓	Hybridization
2014	F <sub>1</sub> seed ↓	Evaluation and selection
2014-2017	F <sub>1</sub> clonal ↓	Increase of plants and selection
2018	F <sub>1</sub> clonal /commercial variety ↓	Graft
2019	Graft F <sub>1</sub> clonal ↓	Evaluation and selection
2020	Paula	Varietal description

In 2018, the clonal hybrid progeny was grafted onto a commercial variety (pattern) using the wedge technique, in Tetela del Monte, Cuernavaca, Morelos (García-Pérez *et al.*, 2017). In 2019, the obtained cuttings were rooted and cultivated in Tehuixtla, Jojutla de Juárez, Morelos (18° 36' 21" N, 99° 11' 55" W, 870 m.a.s.l.), until they reached the final stage. Finally, in 2020, the varietal description of *Euphorbia pulcherrima* Willd. ex Klotzsch was made applying the Guidelines for the Conduct of Tests for Distinctness, Uniformity and Stability (UPOV, 2008).

In 2020, ten Paula poinsettia plants (*i.e.*, ten repetitions) were established in 15.24 cm wide×11 cm high pots (1.61 L); control consisted of an equal number of pots with the Alhely, Beatriz, and Vicky varieties from INIFAP, which were likewise planted in Tehuixtla. A completely randomized experimental design was used. The plants were pruned once and, according to the UPOV guidelines (2008), growth regulators were not applied—a common practice in the commercial management of the crop. Vegetative and bract characteristics were recorded: plant height, stem diameter (mm), number of branches, number of internodes, leaf length (cm), leaf width (cm), leaf petiole length (cm), bract length (cm), bract width (cm), bract petiole length (cm), bract canopy width, and cyatium diameter (cm). An analysis of variance and a Tukey's mean comparison test ( $P \leq 0.05$ ) were performed using the SAS 8.1 statistical software (SAS, 2000).

## RESULTS AND DISCUSSION

### Characteristics

The Paula poinsettia is medium-sized and has a wide breadth and medium branching. It is pale green in the middle third of the stem. It has oval-shaped, long, and broad leaves of the same medium-intensity color, and a wedge-shaped base. It has a long petiole with a pale green upper side. This variety also has many elliptical red bracts of medium length and narrow width (in both cases including the petiole). The color of the upper side of the bract is 45 B and of the underside is 46 C, based on the Royal Horticultural Society color chart (RHS, 2007). Paula reaches the bract pigmentation phenological stage 8 to 9 weeks after autumn begins; consequently, it is classified as an intermediate cycle variety (UPOV, 2008) (Figure 1).



**Figure 1.** Canopy of the Paula poinsettia indoor variety.

### Response

Highly significant statistical differences were found in plant height, stem diameter, number of branches, leaf petiole length, bract length, bract width, and bract canopy width. Statistically significant differences were obtained regarding the number of internodes, leaf length, bract petiole length, and cyathium diameter. No significant differences were found in leaf width.

In terms of plant height, Paula and Beatriz belong to the same statistical group. However, the former was 5.3 cm smaller than the latter, a relevant aspect in ornamental species grown in containers (Table 2). The compact size of this poinsettia is appropriate for its commercial presentation and the transportation of the finished plant to the point of sale.

**Table 2.** Means comparison of vegetative and bract characteristics between the poinsettia Paula variety and control INIFAP varieties.

Character/descriptor	Paula	Alhely	Beatriz	Vicky	DMSH <sup>1</sup>	CV (%) <sup>2</sup>
Plant height (cm)	38.5 b <sup>3</sup>	59.9 a	43.8 b	57.4 a	0.80	9.10
Stem diameter (mm)	10.9 b	14.5 a	10.7 b	13.3 a	0.70	8.93
Number of branches	6.4 b	6.3 b	6.7 b	12.2 a	0.63	25.34
Number of internodes	17.8 ab	18.2 a	14.8 b	17.4 ab	0.23	15.17
Leaf length (cm)	13.0 a	12.1 ab	12.1 ab	10.9 b	0.27	10.70
Leaf width (cm)	8.6 a	7.9 a	7.7 a	7.7 a	0.10	12.92
Leaf petiole length (cm)	4.7 a	4.2 a	3.8 ab	3.2 b	0.36	19.14
Bract length (cm)	11.5 a	9.5 b	10.2 ab	11.9 a	0.32	13.75
Bract width (cm)	5.6 b	5.6 b	4.3 c	7.2 a	0.64	14.57
Bract petiole length (cm)	1.9 b	2.0 ab	2.5 a	2.4 ab	0.24	21.86
Bract canopy width (cm)	28.9 a	22.0 b	29.2 a	27.0 a	0.48	11.85
Cyathium diameter (cm)	4.5 ab	3.4 ab	5.6 a	2.7 b	0.25	47.83

<sup>1</sup>DMSH=Honest Least Significant Difference, <sup>2</sup>CV=Coefficient of variation. Values with different letters within rows indicate significant differences (Tukey, 0.05).

Paula had the longest leaves (13.0 cm) and leaf petioles (4.7 cm), although it is statistically similar to Alhely and Beatriz. Regarding bract length and bract canopy, it was also similar to Beatriz and Vicky. However, Paula recorded the lowest averages in bract width and bract petiole length. Alhely had the largest stem diameter (14.5 mm), as well as the higher number of internodes (18.2).

The commercial value of a poinsettia plant lies in its aesthetics: compact size, greater branching, and bract color (mainly red). Figure 2 shows the Paula variety ready for commercialization; we foresee a good acceptance among producers, propagators, and consumers.

### CONCLUSIONS

Paula is a poinsettia indoor variety with an intermediate cycle. It is medium-sized and has a wide breadth and medium branching. It has many red, elliptical bracts, of medium length and narrow width. Its quality and competitiveness can satisfy the taste and preference of consumers in the domestic and even foreign markets. It can also benefit different links in its production chain.

### ACKNOWLEDGEMENTS

The authors would like to thank the INIFAP for its financial support. They also would like to thank the Canseco Hernández family, second-generation nursery owners from Tetela del Monte, Morelos, for their friendship and invaluable cooperation. Finally, they would like to express their gratitude to the Jardines de México theme park in Tehuixtla, Morelos, for their invaluable collaboration and contribution. Their support allowed the generation of the Paula poinsettia variety.



**Figure 2.** Front view of the Paula poinsettia indoor variety.

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