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New Varieties and Cultivars

New *Gladiolus grandiflorus* cultivars: 'Unemat Leidy Flower', 'Unemat Mary Flower', 'Unemat Rosy Flower', and 'Unemat All Flowers'

Novas cultivares de *Gladiolus grandiflorus*: 'Unemat Leidy Flower', 'Unemat Mary Flower', 'Unemat Rosy Flower', e 'Unemat All Flowers'

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Abstract
Floriculture is a high-value segment of agribusiness with substantial economic, cultural, and ornamental importance. Ornamental plant breeding is directed toward the selection of genotypes with desirable attributes, such as aesthetic quality, greater productivity, and resistance to pests and diseases. Research on *Gladiolus grandiflorus* is focused on developing new, more productive cultivars with novel flower types that differ in predominant tepal and macule colors and flower shape. Distinct floral characteristics are exhibited by the new *Gladiolus* cultivars. 'Unemat Mary Flower' is characterized by reddish-orange tepals with a yellow macule. 'Unemat All Flowers' is characterized by red tepals with a yellow macule and slightly undulate margins. 'Unemat Rosy Flower' is characterized by orange flowers with a yellow macule superimposed on a secondary red macule and undulate margins. 'Unemat Leidy Flower' is characterized by reddish-orange tepals with a central yellow stripe and crispate margins; this combination of traits increases the aesthetic diversity available to the ornamental market. The genetic diversity available to breeding programs and the ornamental industry is increased by the development of these *G. grandiflorus* cultivars. The range of plant materials available for commercial and landscape applications is increased by their distinct combinations of color, floral architecture, and morphological patterns.
Keywords: *Gladiolus* hybrids, Plant breeding, Propagation, Selection.

Resumo
A floricultura é um segmento de alto valor do agronegócio, com expressiva importância econômica, cultural e ornamental. O melhoramento genético de plantas ornamentais é direcionado à seleção de genótipos com atributos desejáveis, como qualidade estética, maior produtividade e resistência a pragas e doenças. As pesquisas com *Gladiolus grandiflorus* concentram-se no desenvolvimento de cultivares mais produtivas e com novos tipos florais, diferenciados pelas cores predominantes das tépalas e das máculas e pelo formato das flores. As novas cultivares de *Gladiolus* apresentam características florais distintas. A cultivar 'Unemat Mary Flower' caracteriza-se por tépalas vermelho-alaranjadas com mácula amarela. A cultivar 'Unemat All Flowers' apresenta tépalas vermelhas com mácula amarela e margens levemente onduladas. A cultivar 'Unemat Rosy Flower' apresenta flores alaranjadas com mácula amarela sobreposta a uma mácula vermelha secundária e margens onduladas. A cultivar 'Unemat Leidy Flower' caracteriza-se por tépalas vermelho-alaranjadas com faixa amarela central e margens crispadas; essa combinação de caracteres amplia a diversidade estética disponível ao mercado ornamental. O desenvolvimento dessas cultivares de G. grandiflorus amplia a diversidade genética disponível aos programas de melhoramento e ao setor ornamental. Suas combinações singulares de cores, arquitetura floral e padrões morfológicos também ampliam a variedade de materiais vegetais disponíveis para uso comercial e paisagístico.
Palavra-chave: Híbridos de *Gladiolus*, Melhoramento genético de plantas, Propagação, Seleção.

Introduction

Floriculture is among the fastest-growing agribusiness sectors worldwide and includes several highly profitable crops (Lima et al., 2020; Alves et al., 2025). Flowers have historically been used throughout the human life cycle, from birth through maturity to death, and have symbolic, therapeutic, and emotional value in addition to their traditional uses (Mitra et al., 2022; Kumar et al., 2024). Considerable phenotypic diversity in commercial and domesticated floricultural crops has been generated by researchers, private-sector flower producers, flower enthusiasts, and amateur growers in accordance with quality and market-acceptance criteria that directly affect the commercial value of the final product (Datta, 2022; Altman et al., 2021; IBRAFLOR, 2025).

During selection, the best genotypes are chosen based on the characteristics desired for a specific plant use. Novelty, characteristics tailored to specific markets, and, increasingly, production systems with reduced environmental effects are valued (Bugallo and Facciuto, 2023). The selection of genotypes with traits desired for commercial use and plant breeding programs is facilitated by species characterization (Javaid et al., 2025). Both characterization and breeding research contribute to the fundamental knowledge required for the development of new cultivars. Parental genotypes are selected using information on heritable traits, plant adaptability, chromosome number, propagation methods, disease resistance, and novel ornamental traits (Datta, 2022; Qian et al., 2022). The subjectivity associated with aesthetic appeal, trends, and public preferences is one of the most challenging aspects of ornamental plant selection (Gabellini and Scaramuzzi, 2022).

This subjectivity has been reduced by predefining selection criteria, ranking genotypes, and assigning trait values using advanced technological methods, thereby allowing new cultivars that comply with the stringent quality standards of the floriculture market to be developed (Cardoso and Vendrame, 2022; Mahanta and Gantait, 2025). The selection criteria and traits evaluated are determined by the intended plant use: cut flowers and foliage, potted plants, or landscape plants (Cardoso and Vendrame, 2022; Bugallo and Facciuto, 2023).

Gladiolus breeding research is primarily directed toward developing cultivars with traits required by the market (Singh et al., 2025). The principal traits sought in new cultivars include high yield, adaptability to different soil and climatic conditions, novel flower colors and shapes, novel flower arrangements on the spike, long spikes, a high flower number, large flowers, and strong stems. Resistance to major pests and diseases, long vase life, high ornamental and commercial quality, tolerance to wide ranges of temperature and light, ease of handling, packaging, and storage, a high corm multiplication rate, and year-round flowering are also desired (Santos et al., 2021; Akhtar et al., 2025).

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The first areas used for *Gladiolus* cut-flower production in Brazil were established in 1950 in Holambra, São Paulo, and *Gladiolus* was rapidly accepted by the market, subsequently becoming one of the principal crops in the region (Barbosa at al., 1999; Tombolato et al., 2010). However, *Gladiolus* breeding remains limited in Brazil. Two species, *Gladiolus grandiflorus* and *G. murielae*, and 32 cultivars are currently registered with the Brazilian Ministry of Agriculture and Livestock (Ministério da Agricultura e Pecuária – MAPA (Brasil, 2025). The earliest *Gladiolus* breeding research in Brazil was initiated during the 1960s at the Agronomic Institute of Campinas (Instituto Agronômico de Campinas, IAC), São Paulo (Tombolato et al., 2002). During the 1980s, two new cultivars were released: 'IAC Paranapanema' and 'IAC Carmim' (Tombolato et al., 2005). The most recently registered cultivars were developed by the State University of Mato Grosso (Universidade do Estado de Mato Grosso, UNEMAT;): 'Unemat Leidy Flower', 'Unemat Mary Flower', 'Unemat Rosy Flower', and 'Unemat All Flowers' (Brasil, 2025).

New cultivars are required because *Gladiolus* provides an alternative source of income for rural producers and because further research on its adaptability to cultivation conditions is needed. The registration of the cultivars 'Unemat Leidy Flower', 'Unemat Mary Flower', 'Unemat Rosy Flower', and 'Unemat All Flowers' is reported, together with information on their development and morphological and agronomic characteristics.

Origin

The cultivars were developed from open-pollinated seeds collected from 'Priscila' and 'Princess Margaret Rose'. Plants of these cultivars were grown in a greenhouse together with 'Gold Field' and 'Traderhorn' under shade cloth that reduced incident solar radiation by 30%. The fruits produced by 'Priscila' and 'Princess Margaret Rose' were identified following flowering and were harvested when fully mature and dry, after which they were transported to the laboratory for seed extraction and cleaning. A total of 497 seeds were collected (Fig. 1A) and dried at room temperature (25 °C) for 10 days; 220 seeds subsequently germinated. The seeds were sown in early September 2022 in 98-cell plastic trays filled with a commercial substrate (Tropstrato®), with one seed placed in each cell. The trays were maintained in a greenhouse and automatically irrigated with an overhead sprinkler system for 5 s every 30 min. Young cormels were harvested 60 days after sowing (Fig. 1B) and placed in newspaper-lined trays to dry at room temperature (25 °C) for 10 days. The dried cormels were packaged in kraft paper bags and stored at 5 °C for 90 days to break dormancy, using a method adapted from Barbosa (2011).



Fig. 1. Development of *Gladiolus grandiflorus* from seed to mature corm during successive cultivation cycles: (A) seed; (B) young cormels from the first cultivation cycle; (C) type 1 cormel from the second cultivation cycle; (D) type 2 cormel from the third cultivation cycle; and (E) mature corm.

The harvested cormels were planted in a greenhouse covered with shade cloth that reduced incident solar radiation by 30% and were irrigated once daily. During the first and second cultivation cycles, the cormels were planted in 2-L pots filled with soil, sand, chicken manure, and commercial substrate at a ratio of 2:1:1:1. New cormels were harvested 120 days after planting during each cultivation cycle. During the four cultivation cycle, the cormels (Fig. 1D) were planted 10 cm deep in beds containing the previously described substrate mixture at the same ratio and fertilized with a 20-5-20 nitrogen-phosphorus-potassium (N-P-K) formulation. Plant spacing was 25 cm between rows and 10 cm within rows. The harvesting, postharvest handling, and cold-storage procedures were repeated during the first (Fig. 1B), second (Fig. 1C), and third (Fig. 1D) cultivation cycles until the corms reached the desired commercial size (Fig. 1E).

The numbers of propagules planted and harvested during the four cultivation cycles are presented in Table 1. By the end of the fourth cultivation cycle, four genotypes had reached the flowering stage and were subsequently characterized morphologically using the *Gladiolus* descriptors established by the International Union for the Protection of New Varieties of Plants (UPOV, 2015). The four genotypes were registered in December 2024 in accordance with the guidelines established by the Brazilian Ministry of Agriculture and Livestock – MAPA (Brasil, 2025), under which comparative trials with commercial cultivars are not required for ornamental species. The registration numbers 58776, 58770, 58779, and 58771 were assigned, respectively, to 'Unemat Mary Flower', 'Unemat All Flowers', 'Unemat Rosy Flower', and 'Unemat Leidy Flower'.

Table 1. Numbers of seeds and cormels sown or planted and germinated or harvested during the four cultivation cycles that resulted in the development of the cultivars 'Unemat Mary Flower', 'Unemat All Flowers', 'Unemat Rosy Flower', and 'Unemat Leidy Flower'. Tangará da Serra, Mato Grosso, Brazil, 2024.

	Seeds	Cormel development (planted / harvested)			
	Seeds / germinated	1st cycle	2nd cycle	3rd cycle	4th cycle
Seeds	497 / 220				
Young cormel		220 / 30			
Type 1 cormel			30 / 27		
Type 2 cormel				27 / 19	
Mature corm					19

Morphological description

The four cultivars were characterized by trimerous flowers with a tubular perianth subtended by a pair of spathaceous bracts, an androecium with three stamens with filaments adnate to the perianth tube and extending to the opening of the floral tube, a terminal style ending in a branched stigma, and a syncarpous, tricarpellary, and trilocular gynoecium.

Genotype G16 was 114.5 cm tall from ground level to the apex of the floral spike and had a stem diameter of 4.5 mm and a plant width of 13.5 cm. Genotype G16 had seven leaves measuring 83.0 cm long and 3.3 cm wide. The floral stem was firm and erect and measured 83.3 cm long and 3.6 mm in diameter. The inflorescence was a 38.0-cm-long spike, measured from the basal floret to the apex, with 11 florets spaced

4.3 cm apart and flowers measuring 10.4 cm in diameter. The flowers were reddish-orange and comprised three outer and three inner tepals. A yellow macule was present within the floral tube, and both the outer and inner tepals had slightly undulate margins (Fig. 2A). Genotype G16 was registered with MAPA under registration number 58776 as the *Gladiolus grandiflorus* Andrews cultivar 'Unemat Mary Flower'.

Genotype G14 was 105.2 cm tall from ground level to the apex of the floral spike and had a robust stem measuring 8.43 mm in diameter and a plant width of 14.1 cm. Genotype G14 had six leaves measuring 75.0 cm long and 3.5 cm wide. The floral stem was firm and measured 78.7 cm long and 2.87 mm in diameter. The inflorescence was a 31.1-cm-long spike, measured from the basal floret to the apex, with six florets spaced 4.3 cm apart and flowers measuring 10.5 cm in diameter. The flowers were red. A yellow macule was present on the outer tepals and the lateral and lower inner tepals, and the inner tepal margins were slightly undulate (Fig. 2B). Genotype G14 was registered with MAPA under registration number 58770 as the *Gladiolus grandiflorus* Andrews cultivar 'Unemat All Flowers'.

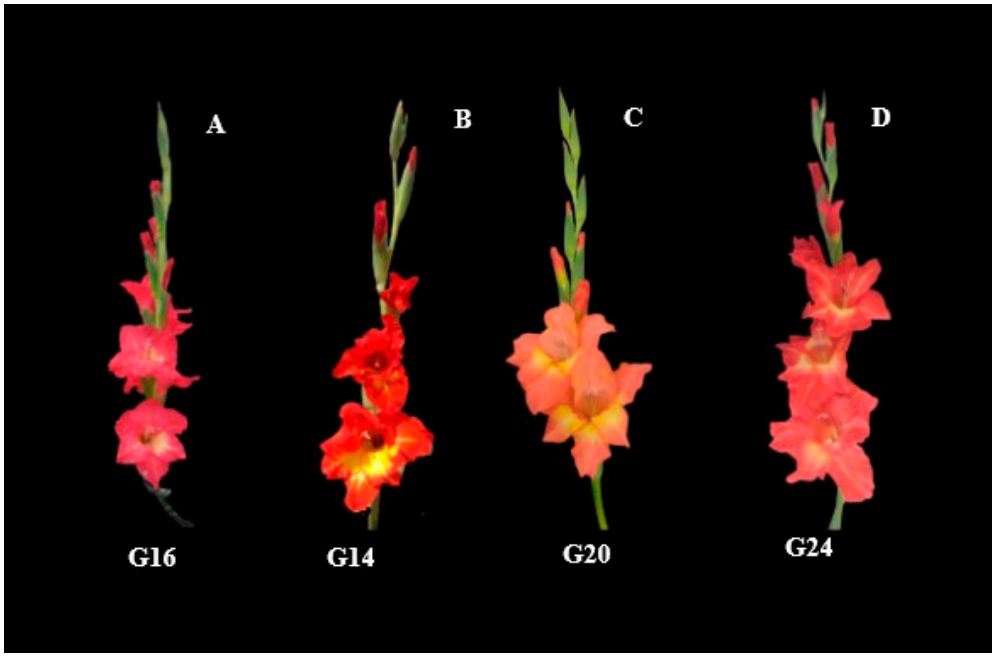


Fig. 2. Cultivars of *Gladiolus grandiflorus*: (A) 'Unemat Mary Flower'; (B) 'Unemat All Flowers'; (C) 'Unemat Rosy Flower'; and (D) 'Unemat Leidy Flower'.

Genotype G20 was 118.3 cm tall from ground level to the apex of the floral spike and had a stem diameter of 4.7 mm and a plant width of 14.3 cm. Genotype G20 had seven leaves measuring 73.1 cm long and 3.7 cm wide. The floral stem was firm and erect and measured 84.5 cm long and 3.5 mm in diameter. The inflorescence was a 43.1-cm-long spike, measured from the basal floret to the apex, with 12 florets spaced 4.5 cm apart and flowers measuring 11.5 cm in diameter. The flowers were orange. A yellow macule superimposed on a secondary red macule was present on the outer and lateral inner tepals, red spots occurred at the opening of the floral tube, and both the outer and inner tepals had undulate margins (Fig. 2C). Genotype G20 was registered with MAPA under registration number 58779 as the *Gladiolus grandiflorus* Andrews cultivar 'Unemat Rosy Flower'.

Genotype G24 was 95.3 cm tall from ground level to the apex of the floral spike and had a stem diameter of 4.7 mm and a plant width of 14.6 cm. Genotype G24 had nine leaves measuring 62.5 cm long and 4.1 cm wide. The floral stem was firm and erect and measured 72.0 cm long and 3.2 mm in diameter. The inflorescence was a 41.0-cm-long spike, measured from the basal floret to the apex, with nine florets spaced 4.5 cm apart and flowers measuring 10.4 cm in diameter. The flowers were reddish-orange. The outer tepals had a central yellow stripe, the inner tepals had yellow macules at the opening of the floral tube, and both the outer and inner tepals had crispate margins (Fig. 2D). Genotype G24 was registered with MAPA under registration number 58771 as the *Gladiolus grandiflorus* Andrews cultivar 'Unemat Leidy Flower'.

Cultivation conditions

The registered cultivars were developed under the soil and climatic conditions of southwestern Mato Grosso, which has a tropical climate with a mean annual temperature of 24.4 °C and distinct dry and rainy seasons (Dallacort et al., 2011). The cultivars were grown in a greenhouse under shade cloth that reduced incident solar radiation by 30% and were irrigated daily.

Performance

Gladiolus plants typically produce one flowering spike per corm; therefore, the potential number of flowering spikes per unit area is strongly influenced by planting density. The cultivars were grown at a spacing of 25 cm between rows and 10 cm within rows, corresponding to an estimated plant density of up to 400,000 plants ha^{-1}.

Propagation

The crop can be propagated sexually or asexually. Sexual propagation is used for plant breeding, whereas asexual propagation through corms and cormels is used for commercial production because it shortens the production cycle and provides a faster financial return (Barbosa, 2011). Registered cultivars should be propagated asexually to preserve their genetic identity.

Uses

Gladiolus cultivars may be used in floral arrangements, bouquets, cut-flower bunches, event decorations, landscape plantings, and gardens.

Availability

The *Gladiolus grandiflorus* cultivars 'Unemat Leidy Flower' (MAPA registration number 58771), 'Unemat Mary Flower' (MAPA registration number 58776), 'Unemat Rosy Flower' (MAPA registration number 58779), and 'Unemat All Flowers' (MAPA registration number 58770) are maintained by UNEMAT.

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Author Contribution

LSN: Conceptualization, Methodology, Formal Analysis, Writing-Original Draft. **ECS:** Methodology. **MHMC:** Conceptualization, Formal Analysis, Investigation. **LGN:** Conceptualization, Methodology, Formal Analysis**. WK:** Conceptualization, Methodology, Formal Analysis. **CAS:** Writing-Review & Editing.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability Statement

Data will be made available upon request to the authors.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

The authors declare that generative AI and AI-assisted technologies were not used in the writing process.

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