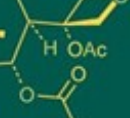
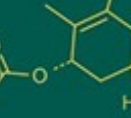
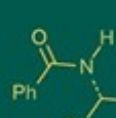
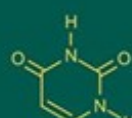


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Plato Basumatary

Department of Floriculture
and Landscaping, Indira
Gandhi Krishi
Vishwavidyalaya, Raipur-
492012 Chhattisgarh, India

Samir Kumar Tamrakar

Department of Floriculture
and Landscaping, Indira
Gandhi Krishi
Vishwavidyalaya, Raipur-
492012 Chhattisgarh, India

Evaluation of Canna lily genotypes for growth, floral and rhizome characteristics

Plato Basumatary¹, Samir Kumar Tamrakar²

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ABSTRACT

A field experiment was conducted during 2024–25 and 2025–26 at the Horticulture Research cum Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh to evaluate morphological variability among 22 *Canna* genotypes. The experiment was laid out in a Randomized Block Design with three replications. Observations were recorded on selected vegetative, floral and rhizome-related traits. Significant variation was observed among the genotypes for all the characters studied, indicating the presence of considerable genetic variability. Plant height ranged from 42.21 to 150.53 cm, with IGC 2 recording the maximum value, whereas Cannova Yellow was the shortest genotype. Stem diameter varied from 1.13 to 3.46 cm, with IGC 2 exhibiting the maximum thickness. Inflorescence length ranged from 12.37 to 54.12 cm, and IGC 2 recorded the longest inflorescence. The number of flowers varied from 8.23 to 21.56, with IGC 12 producing the highest number of flowers. Rhizome fresh weight ranged from 18.06 to 115.27 g, with IGC 6 recording the highest value, while rhizome diameter ranged from 1.61 to 3.38 cm. Rhizome internode length varied from 0.61 to 3.61 cm, whereas the number of nodes and eyes per rhizome ranged from 4.47–15.36 and 1.00–3.62, respectively. Overall, the substantial variation observed in vegetative, floral and rhizome traits indicate considerable morphological diversity among the evaluated *Canna* genotypes.

Keywords: *Canna*, Genetic diversity, Genotypes, Morphological variability, Ornamental traits, Rhizome

Introduction

Canna, commonly known as Indian shot or canna lily, is an important ornamental plant valued for its attractive foliage and diverse flower colours. The genus *Canna* belongs to the monogeneric family Cannaceae under the order Zingiberales. Cytologically, *Canna* exhibits diploid ($2n = 18$), triploid ($2n = 27$), and tetraploid ($2n = 36$) forms. The name *Canna* is derived from the Greek word *kanna*, meaning “reed,” referring to its reed-like herbaceous stem (Singh *et al.*, 2014) [1]. *Canna* is native to the Neotropical region, with its natural distribution extending from the southern United States to northern Argentina, including the West Indies and tropical South America (Sultana *et al.*, 2019; Le *et al.*, 2024) [3, 2]. The genus exhibits considerable ecological adaptability and occurs across diverse habitats, from wetlands and forest margins to roadsides and cultivated areas. The genus comprises approximately 10 wild species and more than 1,000 cultivated hybrids (Patra *et al.*, 2008) [4]. Kamer and Maas (2008) [5] recognized 10 wild species, including *Canna bangii*, *C. flaccida*, *C. glauca*, *C. indica*, *C. iridiflora*, *C. jaegeriana*, *C. liliiflora*, *C. paniculata*, *C. pedunculata* and *C. tuerckheimii*. Modern garden cannas have developed through interspecific hybridization involving several species, particularly *C. indica*, *C. glauca*, *C. iridiflora* and *C. warscewiczii*, with cultivated forms generally grouped under *Canna* × *generalis* and *Canna* × *orchiodes* (Mukherjee *et al.*, 1970; Hannay, 1936) [7, 6]. *Canna* has diverse economic uses. Its starch-rich rhizomes have traditionally been utilized as food and livestock feed, while the seeds have been used for beads, rosaries, and musical instruments. The plant has also been utilized in noodle production, paper manufacture, fodder, confectionery products, and traditional medicine (Gupta *et al.*, 2013; Sari *et al.*, 2016; Kankanamalage *et al.*, 2014; Sultana *et al.*, 2019) [8, 9, 10, 3].

The development and maintenance of superior ornamental cultivars depend on the availability and effective utilization of genetic variability. Characterization and evaluation of diverse *Canna* genotypes are therefore essential for identifying desirable traits and selecting promising genetic resources for breeding and cultivar development. Assessment of morphological variation can provide useful information on the extent of diversity among genotypes and facilitate the identification of superior types for specific ornamental and horticultural purposes.

Corresponding Author:**Plato Basumatary**

Department of Floriculture
and Landscaping, Indira
Gandhi Krishi
Vishwavidyalaya, Raipur-
492012 Chhattisgarh, India

Materials and methods

The present experiment was conducted during 2024–25 and 2025–26 at the Horticulture Research cum Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India. A total of 22 *Canna* genotypes collected from different sources in Chhattisgarh were used for morphological characterization. The genotypes were maintained under field conditions for evaluation of their morphological variation. The experiment was laid out in a Randomized Block Design (RBD) with three replications. The genotypes were planted at a spacing of 45 × 45 cm with uniform agronomic practices were followed throughout the experimental period to maintain comparable field conditions among the genotypes. Ten plants from each genotype were tagged for recording observations.

Result and discussion

The evaluated *Canna* genotypes exhibited significant variation for all the morphological and rhizome-related traits studied (Table 1).

Plant height

Plant height ranged from 42.21 to 150.53 cm, with IGC 2 (150.53 cm) recording the maximum value, followed by IGC 5 (142.30 cm) and Madame Butterfly (134.65 cm), whereas Cannova Yellow (42.21 cm) recorded the minimum plant height. The considerable variation in plant height indicates substantial genetic diversity among the genotypes and may be associated with differences in vegetative vigour and genetic constitution. Similar variation in this trait was also observed by singh *et al.* (2014) and noriko *et al.* (2024) in canna.

Stem diameter

Stem diameter also differed significantly among the genotypes, ranging from 1.13 to 3.46 cm. The maximum stem diameter was recorded in IGC 2 (3.46 cm), followed by IGC 8 (3.26 cm) and Madame Butterfly (3.30 cm), while IGC 14 (1.13 cm) recorded the minimum value. The observed variation in stem thickness may reflect differences in genotype-dependent stem development and overall plant vigour. Similar results were observed by sloan and harkness (2005) in lilium

Inflorescence length

Inflorescence length showed a wide range of variation, from 12.37 to 54.12 cm. IGC 2 (54.12 cm) produced the longest inflorescence and was followed by Madame Butterfly (52.21 cm) and IGC 9 (46.00 cm), whereas IGC 14 (12.37 cm) exhibited the shortest inflorescence. The differences among genotypes may be attributed to genetic variation affecting inflorescence development and elongation. Variation in inflorescence length has also been documented by singh *et al.* (2014) in canna and Mukesh *et al.* (2007) [11] in gladiolus.

Number of flowers

The number of flowers per genotype varied significantly, ranging from 8.23 to 21.56. The highest number of flowers was recorded in IGC 12 (21.56), followed by Madame Butterfly (18.56) and Cannova Yellow (17.48), whereas IGC 10 (8.23) recorded the lowest number of flowers. Variation in flower production among genotypes may be related to differences in genetic potential for floral initiation and development, as well as differences in inflorescence architecture. The observed variation in number of flowers was comparable to that re-

ported by sloan and harkness (2005) and negi *et al.* (2014) in lilium, mukesh *et al.* (2007) and Sankari *et al.* (2012) [12] in gladiolus

Rhizome fresh weight

Rhizome fresh weight exhibited marked variation among the genotypes, ranging from 18.06 to 115.27 g. IGC 6 (115.27 g) recorded the highest rhizome fresh weight, followed by IGC 9 (54.79 g) and IGC 8 (49.42 g), whereas Stripped Beauty (18.06 g) recorded the minimum value and was statistically at par with IGC 11 (20.48 g). The pronounced variability may be associated with genotypic differences in rhizome development and assimilate accumulation. Similar observations were recorded by baranidharan *et al.* (2023) in canna.

Rhizome diameter

Rhizome diameter varied from 1.61 to 3.38 cm among the evaluated genotypes. The maximum rhizome diameter was recorded in IGC 6 (3.38 cm), followed by IGC 9 (3.16 cm) and Madame Butterfly (2.98 cm), whereas Stripped Beauty (1.61 cm) exhibited the minimum value. The variation in rhizome diameter may contribute to the differences observed in rhizome biomass among the genotypes. Similar result was reported by singh *et al.* (2014) in canna.

Rhizome internode length

Rhizome internode length showed substantial variability, with values ranging from 0.61 to 3.61 cm. Madame Butterfly (3.61 cm) recorded the maximum rhizome internode length, followed by IGC 7 (2.26 cm) and IGC 2 (1.09 cm), whereas IGC 9 (0.61 cm) recorded the minimum value. The differences may be associated with genotype-specific patterns of rhizome elongation and internodal development.

Number of nodes per rhizome

The number of nodes per rhizome ranged from 4.47 to 15.36. The maximum number of nodes was observed in IGC 6 (15.36), followed by IGC 9 (14.13), whereas Madame Butterfly (4.47) recorded the minimum number of nodes. Shorter internodes allow more nodes to develop within a given rhizome length, resulting in a higher node count. Similar result was reported by singh *et al.* (2014) and baranidharan *et al.* (2023) in canna.

Number of eyes per rhizome

The number of eyes per rhizome also differed significantly among the genotypes, ranging from 1.00 to 3.62. The highest number of eyes was recorded in Cannova Yellow and IGC 9 (3.62 each), followed by IGC 6 (3.58), whereas IGC 8 (1.00) recorded the minimum value. The observed differences may reflect genotypic variation in rhizome bud initiation. Genotypic variation in the number of eyes per rhizome may be attributed to differences in node production and rhizome architecture. Similar response was reported by singh *et al.* (2014) in canna.

Conclusion

From the present research study, it can be concluded that the growth, flowering and rhizome characteristics of *Canna* genotypes were significantly influenced by their genetic makeup. Considerable variation was observed among the evaluated genotypes for vegetative, floral and rhizome traits, indicating the presence of substantial genetic diversity. Such variability can be effectively utilized for the identification and selection of superior *Canna* genotypes for ornamental purposes and future breeding programmes.

Table 1. Mean pooled performance of both the years (2024-25 and 2025-26) on growth, floral and rhizome parameters

	Plant Height (cm)	Stem Diameter (cm)	Inflorescence Length (cm)	Number of Flowers	Rhizome Fresh Weight (g)	Rhizome Diameter (cm)	Rhizome Internode Length (cm)	Number of Nodes per Rhizome	No. of Eyes per Rhizome
Cannova yellow	42.21 ^k	1.64 ^j	23.84 ^k	17.48 ^b	38.94 ^{cdef}	1.95 ^{fghi}	0.87 ^{kl}	11.26 ^c	3.62 ^a
IGC 1	96.36 ^{fg}	2.14 ^{hi}	36.33 ^{fgh}	11.35 ^{efgh}	27.26 ^{ij}	1.81 ^{ghij}	2.02 ^{cd}	7.15 ^{fg}	1.43 ^{fg}

(continued on next page)

	Plant Height (cm)	Stem Diameter (cm)	Inflorescence Length (cm)	Number of Flowers	Rhizome Fresh Weight (g)	Rhizome Diameter (cm)	Rhizome Internode Length (cm)	Number of Nodes per Rhizome	No. of Eyes per Rhizome
IGC 2	150.53 ^a	3.46 ^a	54.12 ^a	13.66 ^{cd}	41.83 ^{cd}	1.89 ^{fg hij}	1.09 ^{ijk}	10.48 ^{cd}	2.92 ^b
IGC 3	120.91 ^c	2.60 ^{def}	40.39 ^{cde}	10.88 ^{fgh}	35.04 ^{efgh}	1.96 ^{fg hi}	1.59 ^{ef}	8.05 ^{ef}	2.06 ^{de}
Thai princess	60.67 ^j	1.68 ^j	30.18 ^{ij}	19.01 ^b	31.06 ^{ghi}	2.15 ^{def}	1.83 ^{de}	5.95 ^{ghij}	1.85 ^{ef}
IGC 4	109.19 ^{de}	2.27 ^{ghi}	32.71 ^{hij}	12.13 ^{defg}	35.81 ^{defg}	2.05 ^{fgh}	1.63 ^{ef}	9.34 ^{de}	2.59 ^{bcd}
IGC 5	142.30 ^{ab}	3.06 ^{bc}	41.05 ^{cde}	12.03 ^{defg}	32.92 ^{fg hi}	1.86 ^{fg hij}	1.37 ^{fgh}	5.57 ^{ijk}	2.04 ^{de}
Bengal Tiger	95.65 ^{fg}	2.70 ^{def}	44.36 ^{bc}	11.94 ^{defg}	38.61 ^{cdef}	2.36 ^{de}	1.47 ^{fg}	7.02 ^{fgh}	2.39 ^{bcde}
Stripped Beauty	55.50 ^j	2.14 ^{hi}	33.82 ^{hi}	10.55 ^{ghi}	18.06 ^l	1.61 ^j	1.27 ^{ghi}	5.72 ^{hijk}	2.68 ^{bcd}
IGC 6	95.92 ^{fg}	2.71 ^{def}	41.76 ^{cde}	13.57 ^{cd}	115.27 ^a	3.38 ^a	0.77 ^{lm}	15.36 ^a	3.58 ^a
IGC 7	75.30 ⁱ	2.20 ^{hi}	40.11 ^{def}	13.22 ^{de}	24.74 ^{kl}	1.66 ^{ij}	2.26 ^{bc}	4.78 ^{jk}	2.37 ^{bcde}
IGC 8	115.67 ^{cd}	3.26 ^{ab}	40.62 ^{cde}	12.64 ^{defg}	49.42 ^b	2.84 ^c	2.39 ^b	5.60 ^{ijk}	1.00 ^g
IGC 9	108.56 ^{de}	2.73 ^{de}	46.00 ^b	10.99 ^{fgh}	54.79 ^b	3.16 ^{ab}	0.61 ^m	14.13 ^b	3.62 ^a
Madame Butterfly	134.65 ^b	3.30 ^{ab}	52.21 ^a	18.56 ^b	42.50 ^c	2.98 ^{bc}	3.61 ^a	4.47 ^k	1.25 ^{fg}
IGC 10	53.33 ^j	2.41 ^{fgh}	13.13 ^l	8.23 ^j	39.85 ^{cde}	2.43 ^d	1.15 ^{hij}	5.57 ^{ijk}	2.49 ^{bcde}
Cleopatra	122.80 ^c	3.10 ^{bc}	43.17 ^{bcd}	12.75 ^{def}	40.83 ^{cde}	2.45 ^d	2.23 ^{bc}	6.17 ^{ghi}	2.32 ^{bcde}
IGC 11	107.74 ^{de}	2.62 ^{def}	42.58 ^{bcde}	18.04 ^b	20.48 ^{kl}	1.85 ^{fg hij}	1.82 ^{de}	5.57 ^{ijk}	1.85 ^{ef}
IGC 12	100.51 ^{ef}	2.59 ^{def}	38.88 ^{efg}	21.56 ^a	37.95 ^{cdef}	2.09 ^{efg}	1.81 ^{de}	6.75 ^{ghi}	2.40 ^{bcde}
Durban	86.17 ^h	2.87 ^{cd}	29.27 ^j	8.71 ^{ij}	27.60 ^{ij}	1.92 ^{fg hij}	1.29 ^{ghi}	8.13 ^{ef}	2.85 ^{bc}
Alaska	88.34 ^{gh}	2.54 ^{efg}	31.39 ^{ij}	15.48 ^c	29.64 ^{hij}	2.02 ^{fgh}	1.13 ^{hijk}	6.11 ^{ghij}	2.22 ^{cde}
IGC 13	104.52 ^{ef}	2.06 ⁱ	35.70 ^{gh}	9.37 ^{hij}	38.94 ^{cdef}	2.40 ^d	0.92 ^{ijkl}	8.83 ^e	2.16 ^{de}
IGC 14	79.80 ^{hi}	1.13 ^k	12.37 ^l	9.40 ^{hij}	28.30 ^{ij}	1.77 ^{hij}	1.48 ^{fg}	8.14 ^{ef}	2.23 ^{cde}
C.D. 5%	8.59	0.27	3.64	1.90	5.45	0.27	0.24	1.17	0.56
SE(d)	4.26	0.13	1.80	0.94	2.69	0.14	0.12	0.58	0.28

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