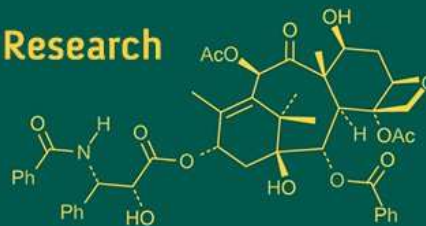
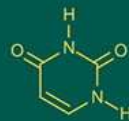
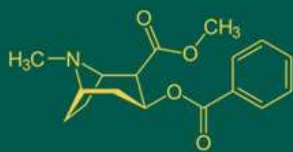


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Genetic variability studies in ivy gourd (*Coccinia grandis* L.) genotypes under hill zone of Karnataka

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Abstract

A field experiment was conducted during 2024-25 at the Department of Vegetable Science, College of Horticulture, Mudigere, to assess genetic variability among sixteen ivy gourd (*Coccinia grandis* L.) genotypes collected from different regions. The experiment followed a Randomized Complete Block Design with three replications. Significant differences were observed among genotypes for all traits, indicating wide genetic variability. High genotypic and phenotypic coefficients of variation were recorded for petiole length, fruit length, number of fruits per vine, fruit yield per vine and fruit yield per hectare, suggesting ample scope for selection. Moderate variability for vine girth, internodal length and branching traits indicated both genetic and environmental influence. High heritability coupled with high genetic advance was observed for vine girth, petiole length, number of secondary branches, fruit yield, TSS and ascorbic acid content, confirming the predominance of additive gene action. These traits can therefore be improved effectively through direct selection. The study highlights the existence of substantial genetic diversity among the genotypes, providing valuable scope for developing high-yielding and nutritionally superior ivy gourd varieties.

Keywords: Ivy gourd, genetic variability, heritability, genetic advance, GCV, PCV and additive gene action

Introduction

Ivy gourd (*Coccinia grandis* L.) commonly known as little gourd or scarlet gourd, is a perennial, dioecious vine belonging to the family Cucurbitaceae with chromosome number $2n = 24$. It is native to India and widely cultivated in Tamil Nadu, Karnataka, Kerala, Maharashtra, Gujarat, Andhra Pradesh, Telangana, Bihar, Uttar Pradesh, West Bengal and Odisha (Suranjana *et al.*, 2024) ^[10]. The crop also grown in Myanmar, Sri Lanka and Malaysia, serves as an important “poor man’s vegetable” due to its nutritional, medicinal and economic significance (Yadav *et al.*, 2024) ^[15].

Nutritionally, ivy gourd fruits contain 94% moisture, 1-2 g protein, 3.1 g carbohydrates, 156 µg carotene, 14 mg iron and 28 mg ascorbic acid per 100 g edible portion (Tak *et al.*, 2020) ^[12]. The crop also exhibits therapeutic properties and is used traditionally to treat diabetes, bronchitis, fever and skin ailments. Immature fruits, tender shoots and leaves are consumed as vegetables in various culinary forms such as curries, pickles and soups.

Ivy gourd grows well in hot and humid climates and prefers sandy loam soils with good drainage but is sensitive to shade and water logging (Suranjana *et al.*, 2024) ^[10]. Being a highly heterozygous and cross-pollinated species, it exhibits wide genetic variability, offering immense potential for genetic improvement. Estimation of genetic parameters, such as genotypic and phenotypic coefficients of variation, heritability and genetic advance, is essential for identifying promising genotypes.

Materials and Methods

The current study was carried out during *Kharif* 2024-25 at the Department of Vegetable Science, College of Horticulture, Mudigere. The experimental site is located at 13.25° N latitude, 75.25° E longitude and 980 m above mean sea level, representing the hill zone of Karnataka. The region experiences a humid tropical climate with an annual rainfall of 225.78 mm and mean temperature ranging between 19.4 °C and 27.3 °C.

The experimental soil was red sandy loam in texture.

The experimental material comprised of sixteen genotypes (Table 1), including fifteen genotypes collected from diverse agro-climatic regions and one local check, 'Mudigere Local-1'. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. Each plot measured 9 m × 7.2 m, with a spacing of 1.8 m × 1.8 m and the crop was trained on a bower system. Recommended cultural and plant protection practices were followed uniformly for all genotypes.

Observations were recorded on quantitative and qualitative traits such as vine length, vine girth, internodal length, petiole length, number of primary and secondary branches, days to first female flower, days to 50% flowering, days to first fruit set and fruit harvest, fruit length, fruit diameter, fruit volume, average fruit weight, number of fruits per vine,

fruit yield per vine, fruit yield per hectare, total soluble solids, ascorbic acid, total chlorophyll, protein and carotenoid content.

The data were subjected to analysis of variance (ANOVA) as suggested by Panse and Sukhatme (1957) [7] to determine the significance of differences among genotypes. The mean values were used to estimate genetic parameters. The Genotypic Coefficient of Variation (GCV) and Phenotypic Coefficient of Variation (PCV) were computed to assess the extent of variability. Broad-sense heritability (h^2) was estimated as per Johnson *et al.* (1955) [5] and categorized as low (< 30%), moderate (30-60%) or high (> 60%). Genetic advance (GA) and genetic advance as a percentage of mean (GAM) were also calculated to determine the expected genetic improvement through selection.

Table 1: List of genotypes and check used for the study

Sl. No.	Genotypes	Source of collection
1.	Arka Neelachal Khunki	CHES, Bhubaneswar, Odisha
2.	Arka Neelachal Sabuja	CHES, Bhubaneswar, Odisha
3.	Indira Kundru-5	College of Agriculture, IGKV Raipur
4.	Indira Kundru-35	College of Agriculture, IGKV Raipur
5.	Shivamogga Local Selection	Farmers field, Shivamogga
6.	Neelavara Local Selection-2	ZAHRS, Brahmapara
7.	Hanehalli Local Selection-1	ZAHRS, Brahmapara
8.	Hanehalli Local Selection-2	ZAHRS, Brahmapara
9.	Sooral Local Selection	ZAHRS, Brahmapara
10.	Kokkarne Local Selection	ZAHRS, Brahmapara
11.	Sathvadi Local Selection	ZAHRS, Brahmapara
12.	Malur Local Selection	Farmers field, Malur
13.	Hoskote Local Selection	Farmers field, Hoskote
14.	Devanahalli Local Selection	Farmers field, Devanahalli
15.	DRC-1	UAS, Dharwad
16.	Mudigere local-1 (Check)	Farmers field, Mudigere

Results and Discussion

The analysis of variance revealed highly significant differences among ivy gourd genotypes (Table 2) for all the traits studied, indicating the presence of wide genetic variability. Considerable variation was observed for growth, yield and biochemical parameters, suggesting diverse genetic potential among the genotypes. The significant variability in traits such as vine length, fruit yield and nutritional components like ascorbic acid and carotenoids indicates ample opportunities for selection and improvement. The existence of such broad genetic variation provides a strong basis for effective selection and breeding strategies aimed at developing high-yielding and nutritionally superior genotypes in ivy gourd.

The presence of variability in sixteen ivy gourd genotypes was assessed in terms of range, phenotypic coefficient of variation (PCV), genotypic coefficient of variance (GCV), heritability (broad sense) and genetic advance (Table 3). The range of variability for vine length (198.47 cm to 312.19 cm), vine girth (0.45 cm to 0.80 cm), internodal length (6.49 cm to 10.15 cm), petiole length (1.99 cm to 4.25 cm), number of primary branches (5.65 to 7.75), number of secondary branches (3.50 to 5.90), node at first female flower appears (6.10 to 13.15), days to first female flowering (33.50 days to 62.00 days), days to fifty per cent flowering (44.00 days to 72.00 days), days to first fruit set (38.50 days to 67.00 days), days to first fruit harvest (43.50 days to 72.00 days), fruit length (3.50 cm to 8.99 cm), fruit diameter (1.85 cm to 2.72 cm), fruit volume (15.10 cc to

21.50 cc), average fruit weight (16.00 g to 23.50 g), number of fruits per vine (74.00 to 165.00), fruit yield per vine (1.18 kg to 3.88 kg), fruit yield per hectare (3.65 t to 12.00 t), TSS (1.70 °Brix to 3.40 °Brix), ascorbic acid (10.00 mg to 21.66 mg), total chlorophyll content (0.76 mg to 1.06 mg), protein content (970.55 mg to 1300.35 mg) and carotenoid content (268.10 mg to 368.50 mg).

The experimental material of ivy gourd exhibited a broad range of variation, with high magnitudes of both genotypic and phenotypic coefficients of variation observed for traits such as petiole length (20.72% and 22.12%), fruit length (22.97% and 24.27%), number of fruits per vine (23.17% and 24.43%), fruit yield per vine (33.89% and 34.76%) and fruit yield per hectare (34.41% and 35.27%). Such variability reflects the diverse genetic makeup of the accessions, likely influenced by their geographical origin and the natural outcrossing behaviour of the species. The presence of considerable variation in both vegetative and reproductive traits indicates polygenic inheritance, providing ample opportunity for genetic improvement through selection. High GCV and PCV values for yield and its associated traits suggest that these characteristics are primarily under genetic control and less affected by environmental factors, making them reliable for selection in breeding programs. The overall results emphasize the predominance of additive gene action governing these traits, signifying their potential for effective selection and enhancement of yield performance in ivy gourd. The results correspond with the results of Saikia *et al.* (2017) in ivy

gourd for yield per plant and number of fruits per plant and by Bharti and Jha (2018) ^[2] for primary branches, vine length and fruit number in ivy gourd, Ahmad *et al.* (2019) ^[1] in bottle gourd, Nithinkumar *et al.* (2022) ^[6] in bitter gourd confirmed that fruit yield and related characters consistently exhibited high genetic variability, suggesting the predominance of additive gene action and their effectiveness for selection and Hembron *et al.* (2025) ^[4] in ivy gourd documented high variability for fruit yield per plant.

Moderate levels of genotypic and phenotypic variation were recorded for vine girth (14.80% and 16.80%), internodal length (10.62% and 13.29%), number of primary (10.03% and 12.84%) and secondary branches (16.93% and 18.74%), node at first female flower appearance (17.88% and 19.89%), days to fifty per cent flowering (16.32% and 18.39%), days to first fruit set (17.89% and 19.83%) and days to first fruit harvest (16.02% and 18.12%). This moderate variability suggests that these traits are controlled by both genetic and environmental factors, limiting the effectiveness of direct selection. The influence of non-additive gene action and environmental interaction on these traits indicates that improvement may require advanced breeding approaches rather than simple selection methods. These findings are consistent with Vijayakumar *et al.* (2020) ^[14] in ridge gourd, Chandramouli *et al.* (2021) ^[3] in bottle gourd and Singh *et al.* (2023) ^[9] in bottle gourd, where yield-related characters such as vine length, fruit length and number of fruits per vine exhibited moderate GCV and PCV values.

High heritability combined with high genetic advance as a percentage of mean was recorded for vine girth (77.66% and

26.88%), petiole length (87.72% and 39.98%), number of secondary branches (81.62% and 31.52%), node at first female flower appears (80.80% and 33.11%), days to first female flowering (84.38% and 37.85%), days to fifty per cent flowering (78.82% and 29.85%), days to first fruit set (81.43% and 33.26%), days to first fruit harvest (78.15% and 29.17%), fruit length (89.57% and 44.78%), number of fruits per vine (89.95% and 45.27%), fruit yield per vine (95.05% and 68.06%), fruit yield per hectare (95.19% and 69.16%), TSS (85.15% and 36.85%) and ascorbic acid (85.75% and 37.90%). This association indicates that these traits are predominantly governed by additive gene action and are less influenced by environmental factors. Therefore, simple selection based on phenotypic performance would be effective for improving these traits. The presence of high heritability and genetic advance suggests that considerable genetic gain can be achieved through direct selection, making these traits reliable indicators for yield and quality improvement in ivy gourd. Similar results were reported by Tamang *et al.* (2018) ^[13] in cucumber for fruit weight, fruit length, fruit girth and fruit yield per plant, Reddy and Devi (2019) ^[8] in bitter gourd for fruit yield per hectare, fruit length and fruit yield per plant, while Tak *et al.* (2020) ^[12] in ivy gourd for petiole length, leaf length, leaf width, fruit weight and ascorbic acid content. Suvedha *et al.* (2023) ^[11] in ridge gourd for vine length, primary branches, flowering nodes, fruit length, number of fruits per vine, fruit weight and TSS, suggesting the predominance of additive gene action and Hembron *et al.* (2025) ^[4] in ivy gourd for number of fruits per plant and fruit yield per plant.

Table 2: Analysis of variance for different characters in ivy gourd

Sl. no.	Source	Replication	Treatment	Error
	Degrees of freedom	2	15	30
1.	Vine length (cm)	178.19	2119.65**	442.48
2.	Vine girth (cm)	0.001	0.03**	0.002
3.	Internodal length (cm)	0.16	2.73**	0.43
4.	Petiole length (cm)	0.01	1.13**	0.05
5.	Number of primary branches	0.12	1.48**	0.26
6.	Number of secondary branches	0.06	1.88**	0.13
7.	Node at first female flower appears	0.53	10.44**	0.77
8.	Days to first female flowering	18.85	280.69**	16.31
9.	Days to 50 per cent flowering	24.18	290.20**	23.86
10.	Days to first fruit set	21.53	279.85**	19.78
11.	Days to first fruit harvest	24.45	277.95**	23.70
12.	Fruit length (cm)	0.07	6.50**	0.24
13.	Fruit diameter (cm)	0.02	0.19**	0.04
14.	Fruit volume (cc)	0.87	9.54**	1.95
15.	Average fruit weight (g)	1.03	11.86**	2.33
16.	Number of fruits per vine	22.81	1989.15**	71.44
17.	Fruit yield per vine (kg)	0.01	1.61**	0.03
18.	Fruit yield per hectare (tons)	0.07	15.94**	0.26
19.	TSS (°Brix)	0.02	0.91**	0.05
20.	Ascorbic acid (mg/100g)	0.74	28.93**	1.52
21.	Total chlorophyll content (mg/g of fresh weight)	0.002	0.02**	0.005
22.	Protein content (mg/100g)	3477.76	33600.27**	7960.55
23.	Carotenoid content (mg/100g)	343.26	2775.47**	707.47

Table 3: Genetic parameters of variation for fruit yield and its component characters in ivy gourd

Characters	Mean	Range		GCV (%)	PCV (%)	h ² (%)	GA	GAM (%)
		Minimum	Maximum					
Vine length (cm)	262.39	198.47	312.19	9.01	12.06	55.82	36.39	13.87
Vine girth (cm)	0.59	0.45	0.80	14.80	16.80	77.66	0.16	26.88
Internodal length (cm)	8.23	6.49	10.15	10.62	13.29	63.86	1.44	17.48
Petiole length (cm)	2.89	1.99	4.25	20.72	22.12	87.72	1.16	39.98
Number of primary branches	6.36	5.65	7.75	10.03	12.84	61.06	1.03	16.15
Number of secondary branches	4.51	3.50	5.90	16.93	18.74	81.62	1.42	31.52
Node at first female flower appears	10.04	6.10	13.15	17.88	19.89	80.80	3.33	33.11
Days to first female flowering	46.94	33.50	62.00	20.00	21.77	84.38	17.76	37.85
Days to 50 per cent flowering	57.72	44.00	72.00	16.32	18.39	78.82	17.23	29.85
Days to first fruit set	52.03	38.50	67.00	17.89	19.83	81.43	17.31	33.26
Days to first fruit harvest	57.47	43.50	72.00	16.02	18.12	78.15	16.76	29.17
Fruit length (cm)	6.29	3.50	8.99	22.97	24.27	89.57	2.81	44.78
Fruit diameter (cm)	2.32	1.85	2.72	9.66	12.66	58.22	0.35	15.18
Fruit volume (cc)	17.52	15.10	21.50	9.08	12.08	56.51	2.46	14.06
Average fruit weight (g)	19.20	16.00	23.50	9.28	12.23	57.66	2.79	14.52
Number of fruits per vine	109.13	74.00	165.00	23.17	24.43	89.95	49.40	45.27
Fruit yield per vine (kg)	2.14	1.18	3.88	33.89	34.76	95.05	1.46	68.06
Fruit yield per hectare (tons)	6.64	3.65	12.00	34.41	35.27	95.19	4.59	69.16
TSS (°Brix)	2.77	1.70	3.40	19.39	21.01	85.15	1.02	36.85
Ascorbic acid (mg/100g)	15.22	10.00	21.66	19.87	21.45	85.75	5.77	37.90
Total chlorophyll content (mg/g of fresh weight)	0.87	0.76	1.06	8.97	12.06	55.28	0.12	13.74
Protein content (mg/100g)	1124.37	970.55	1300.35	8.22	11.43	51.78	137.03	12.19
Carotenoid content (mg/100g)	321.34	268.10	368.50	8.17	11.63	49.35	38.00	11.82

Conclusion

In conclusion, the present study on ivy gourd genotypes revealed significant genetic variability for growth, yield and quality traits, highlighting substantial potential for genetic improvement. High genotypic and phenotypic coefficients of variation, along with high heritability and genetic advance, were recorded for key traits such as fruit length, number of fruits per vine, fruit yield per vine, fruit yield per hectare, TSS and ascorbic acid content. These results indicate the predominance of additive gene action and suggest that effective improvement can be achieved through direct selection. The findings emphasize the importance of genetic diversity in developing superior ivy gourd genotypes with enhanced yield and nutritional quality, contributing to its commercial and economic value.

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