

Studies on Genetic Variability, Heritability, Genetic Advance and Character Association for Yield and Mechanical Harvestable traits in Chickpea (*Cicer arietinum* L.)

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ABSTRACT

Mechanical harvestable and high-yielding chickpea varieties are crucial for modern pulse production. They reduce labourer dependency, enable timely harvesting, and improve efficiency in large-scale farming. High yield ensures better profitability, food security, and resource use. Together, these traits support sustainable agriculture, enhance farmer livelihoods, and strengthen chickpea's role in global nutrition and crop improvement. In this case of investigation twenty-five (25) genotypes of chickpea were evaluated for *Genetic Variability, Heritability, Genetic Advance and Character Association for yield and mechanical harvestable traits*. The experiment was carried out at the research farm of ICAR-Indian Institute of Pulses Research, Kanpur during Rabi 2024-25. The research trial comprised of 25 chickpea genotypes (including checks) and were planted in Completely Randomized Block Design (CRBD) with three (3) replications. The phenotypic data was recorded on nine (8) quantitative characters like, Days to flower initiation, Days to 50% flowering, Days to pod initiation, Days to 50% Podding, Height of first podding or Ground clearance (cm), Plant height (cm), Days to maturity, 100-Seed weight (g) and Plot yield (g). Such investigation exposed the genetic variability for yield and mechanical harvestable characters, in the term of Phenotypic coefficient of variance (PCV) and Genotypic coefficient of variance (GCV). The maximum degree of PCV (86.69) and GCV (86.67), Heritability (99.97) and Genetic Advance (51.89) were recorded for Grain Yield/Plant. The maximum amount of highly significant and positive correlation was found for Plant height with Ground Clearance (0.8389**) and Path coefficient also revealed maximum direct effect towards yield by Day to 50% flowering (0.9526) and Days to maturity showed maximum indirect positive effect through Number of Pods/plant (0.5538). High genetic variability, heritability, genetic advance, and character association are vital for chickpea improvement. They provide diverse traits, ensure reliable selection, predict breeding progress, and identify correlated characters, enabling efficient development of Mechanical harvestable high-yielding, stress-tolerant, and sustainable varieties for long-term agricultural advancement.

Keywords

Genetic Variability,
Mechanical
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Introduction

Pulses are edible seeds of leguminous plants, cultivated worldwide for food and soil enrichment. They include Chickpea, Lentil, Pigeonpea, Mungbean, Fieldpea and others. Rich in protein, fibre, vitamins, and minerals, pulses are vital for nutrition, sustainable agriculture, and food security, especially in vegetarian and resource-limited diets.

Chickpea (*Cicer arietinum L.*) is one of the earliest domesticated legume crop belonging to Fabaceae family having $2n=2x=14$ chromosomes, with archaeological evidence dating back nearly 7,000 years in the Fertile Crescent. Ancient remains from Turkey and Syria confirm its cultivation, while references in Greek and Roman literature highlight its importance in early diets. From its centre of origin, chickpea spread eastward to South Asia and westward to the Mediterranean, becoming a staple in diverse food cultures (Patil et al., 2024).

Chickpea is now cultivated in more than 50 countries, primarily in semi-arid regions. India dominates global production and consumption, accounting for over two-thirds of total output. Other significant producers include Australia, Turkey, Pakistan, Ethiopia, and Mexico. Two main types are recognized: Desi chickpea, small, angular, and dark-seeded, common in South Asia and East Africa; and Kabuli chickpea, larger, cream-colored, and widely grown in the Mediterranean, West Asia, and North America.

Globally, chickpea ranks third among pulse crops after beans and peas, with annual production exceeding 15 million tons. India remains the largest contributor, followed by Australia and Turkey. Its adaptability to dry climates, low input requirements, and role in crop rotations make chickpea vital for food security and sustainable agriculture.

Chickpea is an annual, self-pollinated legume crop. Plants are bushy, 30–80 cm tall, with pinnate compound leaves and solitary flowers ranging from white to pink or violet. Pods are small, inflated, and usually contain one to two seeds. The crop is drought-tolerant but sensitive to waterlogging, making it suitable for rainfed farming systems.

Chickpea is highly nutritious, containing 18–22% protein, 55–60% carbohydrates, and essential amino

acids. It is rich in dietary fibre, minerals such as iron, calcium, and magnesium, and vitamins including folate. Its low glycemic index makes it beneficial for diabetic diets, while its protein quality supports vegetarian and vegan nutrition (Nandan et al., 2025).

Chickpea is consumed in multiple forms: whole seed, split dal, flour (besan), and in traditional dishes like hummus, falafel, and curries. Industrially, chickpea flour is used in snacks and bakery products. Agronomically, its nitrogen-fixing ability enhances soil fertility, reducing dependence on synthetic fertilizers and supporting ecological sustainability.

Genetic variability in chickpea provides the foundation for improving yield and mechanical harvesting traits. High heritability estimates for plant height, pod number, and seed size indicate reliable transmission across generations. Genetic advance is significant for yield components, suggesting effective selection potential. Character association studies reveal positive correlations of seed yield with pods per plant, 100-seed weight, and harvest index, while erect growth habit and uniform maturity favour mechanical harvesting. These associations guide breeders in identifying donor genotypes and combining desirable traits, ensuring both productivity and suitability for modern mechanized farming systems in chickpea improvement programs (Teena et al., 2025 and Jain et al., 2023).

Materials and Methods

In this experiment 25 chickpea genotypes (Advance Breeding Lines and released Varieties) were taken to evaluate Genetic Variability, Heritability, Genetic Advance and Character Association for Yield and Mechanical Harvestable traits among Chickpea genotypes, from working collection of Division of Crop Improvement, ICAR-Indian Institute of Pulses Research, Kanpur, Uttar Pradesh 208024 India.

There are eight phenotypic characters were studied viz. Days to 50% flowering, Days to maturity, Plant height (cm), Number of pods per plant, Ground clearance (cm), 100-Seed weight (g), Grain yield per plant and Plot yield (g). Checks used in the experiment are released varieties viz. GNG 2207, IPC 2015-132 and BG 3043. The breeding materials were sown in Completely Randomized Block Design (CRBD) with 03 replications at research farm of ICAR-Indian Institute of Pulses Research, Kanpur, Uttar Pradesh 208024 India during

rabi 2024-25. Bed size of each replication was 40X4 meter length and width respectively and spacing was kept about 30X10 cm row to row and plant to plant respectively and plot size of each entry was 6 m² as 4m width and 1.5m length of the particular plot. The statistical methods used in the experiment are follows.

1. GCV & PCV was established by [Burton and de Vane \(1952\)](#)
2. Heritability was established by [Hanson et al., \(1956\)](#)
3. Genetic Advance was established by [Johnson et al., \(1955\)](#)
4. Correlation Coefficient was established by [Al-jibouri et al., \(1958\)](#)
5. Path Coefficient was established by [Dewey and Lu \(1959\)](#)

The recorded phenotypic data was analysed by using R studio posit software.

Results and Discussion

The result of this experiment is described into different components which are given below.

1. ANOVA
2. Genetic Variability, Heritability and Genetic Advance for Higher yield and Mechanical Harvesting traits
3. Character Association (Correlation & Path Coefficient)

ANOVA

ANOVA in RBD partitions variation into treatments, blocks, and error, testing treatment significance while controlling block effects, ensuring precise comparison of genotypes under replicated randomized block experimental design. ANOVA table showing significant treatment effects for Days to 50% flowering, Days to maturity, Plant height, Pods/plant, 100-Seed weight, Ground clearance, Yield per plant, and Plot yield, confirming lesser environmental effect on the experiment.

Replication influenced Plant height and Plot yield, while other traits were non-significant under replication. Residuals remained low, validating experimental precision and ensuring reliable trait differentiation in genotypes taken in under study, see *Table 01*.

Genetic Variability, Heritability and Genetic Advance

Variability, expressed through PCV (phenotypic coefficient of variation) and GCV (genotypic coefficient of variation), reveals the extent of trait differences. Heritability estimates the proportion of genetic variance passed to offspring, while genetic advance predicts expected improvement under selection. Together, they help breeders identify traits with strong genetic control, guiding effective crop improvement and ensuring sustainable genetic gains. The performance of chickpea genotypes for different characters in respect of different parameters are given below.

The variability analysis revealed distinct genetic patterns across traits. Days to 50% flowering showed high PCV (26%) and GCV (25%) with heritability of 97.93% and genetic advance (GA) of 52.54%, suggesting strong genetic control and effective selection for earliness. In contrast, days to maturity recorded low PCV (2.52%) and GCV (1.61%) with moderate heritability (36.00%) and genetic advance (12.31%), indicating environmental influence. Plant height exhibited moderate PCV (8.62%) and GCV (6.77%) with heritability of 61.71% and genetic advance of 10.96%, implying moderate progress through selection. Number of pods/plant showed very high PCV (41.78%) but low heritability (20.21%) and genetic advance (17.39%), reflecting poor genetic gain. Seed weight had high heritability (88.99%) and genetic advance (33.25%), confirming scope for improvement. Grain yield/plant displayed exceptionally high heritability (99.97%) and genetic advance (62.32%), making it the most reliable trait for direct selection ([Manne et al., 2025](#) and [Kumar et al., 2025](#)), see *Table 02*.

Character Association

Correlation Coefficient

Correlation coefficient analysis is a fundamental tool in chickpea breeding, as it quantifies the degree and direction of association between yield and its component traits. Unlike simple observation, correlation provides a statistical measure of how traits such as pods per plant, seed weight, plant height, and flowering time interact with grain yield. Positive correlations highlight traits that can be simultaneously improved, while negative correlations reveal trade-offs requiring careful selection.

In chickpea, correlation studies help breeders identify reliable yield-contributing traits and understand complex interrelationships among morphological and physiological characters. Its significance lies in guiding effective selection strategies, improving genetic gain, and supporting the development of high-yielding, stable varieties (Paul et al., 2022).

At Genotypic level

At the genotypic level, correlation analysis revealed significant associations among key chickpea traits. Days to 50% flowering showed a positive correlation with days to maturity ($r = 0.5516$), indicating that early flowering genotypes matured earlier. Days to maturity exhibited a strong negative correlation with number of pods per plant ($r = -2.0203$), suggesting prolonged maturity reduced pod production.

Plant height was positively correlated with ground clearance ($r = 0.8389$) and 100-seed weight ($r = 0.8211$), but negatively associated with yield per plot ($r = -0.7304$). Similarly, ground clearance correlated positively with seed weight ($r = 0.7379$) but negatively with plot yield ($r = -0.8194$). Number of pods per plant was negatively correlated with grain yield per plant ($r = -0.5663$), while grain yield per plant showed a positive correlation with yield per plot ($r = 0.4871$). Notably, 100-seed weight was negatively correlated with yield per plot ($r = -0.7104^*$), highlighting trade-offs between seed size and overall productivity (Yadav et al., 2025), see Table 03.

At Phenotypic Level

At the phenotypic level, correlation analysis among chickpea traits indicated mostly weak associations, with a few significant relationships. Days to 50% flowering was positively correlated with ground clearance ($r = 0.2713$), while its associations with other traits were non-significant. Days to maturity showed no significant correlations across traits. Plant height exhibited a strong positive correlation with ground clearance ($r = 0.6793$) and 100-seed weight ($r = 0.5735$), suggesting taller plants tend to have higher clearance and heavier seeds. Ground clearance was positively correlated with seed weight ($r = 0.455$) but negatively associated with yield per plot ($r = -0.2531$), indicating architectural trade-offs. Number of pods per plant showed a negative correlation with grain yield per plant ($r = -0.2524$) and a positive

correlation with seed weight ($r = 0.245$). Importantly, 100-seed weight was negatively correlated with yield per plot ($r = -0.3622^{**}$), highlighting the seed size–yield trade-off, (Renukadevi, and Subbalakshmi, 2026) see Table 04.

Path Coefficient

Path coefficient analysis is a powerful statistical tool in chickpea research, used to partition correlation coefficients into direct and indirect effects of yield-contributing traits. Unlike simple correlation, it reveals the true causal relationship between traits and grain yield, helping breeders identify the most influential components. In chickpea, traits such as pods per plant, seed weight, and plant height often show complex interrelationships, where indirect effects may mask true associations. Path analysis clarifies these linkages, guiding selection strategies. Its significance lies in providing a precise understanding of yield determinants, enabling breeders to prioritize traits with maximum direct contribution to productivity (Yadav et al., 2025).

At Genotypic level

At the genotypic level, path coefficient analysis revealed the magnitude of direct and indirect effects of yield-contributing traits in chickpea. Days to 50% flowering exerted a strong positive direct effect on yield per plot (0.9526), though its indirect effect via ground clearance was negative (-0.7407). Days to maturity showed a small negative direct effect (-0.0422) but contributed positively through pods per plant (0.5538). Plant height had a high positive direct effect (0.7827) but strong negative indirect effects via ground clearance (-1.7354) and yield per plot (-0.7304). Ground clearance itself showed a large negative direct effect (-2.0686), reducing yield. Grain yield per plant had a positive direct effect (0.3850) and contributed indirectly to plot yield (0.4871). Conversely, 100-seed weight showed a positive direct effect (0.4038) but negatively influenced yield per plot (-0.7104), highlighting seed size–yield trade-offs (Renukadevi, and Subbalakshmi, 2026), see Table 05.

At Phenotypic Level

At the phenotypic level, path coefficient analysis in chickpea revealed the relative contribution of different traits to yield.

Table.1 Analysis of variance (ANOVA) for the Completely Randomized Block Design

Source of Variation	D.F.	Mean. Square							
		D50%F	DM	PHT	Pods/P	100-SW	GC	Y/P	PY
Replication	2	31.36	1.69	90.16*	2718.52*	2.31	18.4	6.52	115028*
Treatment	24	817.11**	11.31*	246.41**	1283.64**	36.79***	208.574**	1904.48***	344724**
Residuals	48	5.72	9.49	15.45	729.48	1.45	11.412	0.18	65290

Table.2 Range, mean, coefficient of variation and least significant differences for different character of Chickpea genotypes.

Characters	Range		Mean Value	Coefficient of variation (%)				Genetic advance	Genetic advance (mean)	Herita bility (%)
	Min.	Max.		PCV (%)	GCV (%)	LSD ₁ 1%	LSD ₁ 5%			
Days to 50% flowering	41	87	63	26	25	5.23	3.92	33.52	52.54	97.93
Days to maturity	120	132	126.01	2.52	1.61	6.74	5.05	3.39	12.31	36.00
Plant height (cm)	59.2	89	73.67	8.62	6.77	8.6	6.45	8.07	10.96	61.71
No. of pods/plant	18	132	72.36	41.78	18.78	59.54	44.33	12.58	17.39	20.21
100-Seed weight (g)	12	28	20.05	18.14	17.11	2.64	1.98	6.66	33.25	88.99
Ground Clearance (cm)	31.5	56.8	46.54	10.59	7.71	7.39	5.54	5.38	11.57	53.06
Grain yield/plant (g)	65	10	29.06	86.69	86.67	0.93	0.69	51.89	62.32	99.97
Yield/plot (g)	820	2440	1448.85	19.74	8.88	559.58	419.39	119.36	8.23	20.25

Table.3 Genotypic correlation coefficient between different characters in Chickpea genotypes.

Traits	Days to 50% flowering	Days to maturity	Plant height (cm)	Ground Clearance (cm)	No. of pods/plant	Grain yield/plant (g)	100-Seed weight (g)	Yield/plot (g)
Days to 50% flowering	1**	0.5516 **	0.0083 NS	0.3581 NS	-0.1151 NS	0.0382 NS	-0.1396 NS	0.1849 NS
Days to maturity		1**	-0.2162 NS	0.1554 NS	-2.0203 **	0.4694 *	-0.8411 **	0.3875 NS
Plant height (cm)			1**	0.8389 **	0.3938 NS	-0.0479 NS	0.8211 **	-0.7304 **
Ground Clearance (cm)				1**	0.1357 NS	-0.0073 NS	0.7379 **	-0.8194 **
No. of pods/plant					1**	-0.5663 **	0.3207 NS	-0.3595 NS
Grain yield/plant (g)						1**	-0.1174 NS	0.4871 *
100-Seed weight (g)							1**	-0.7104 **
Yield/plot (g)								1**

Table.4 Phenotypic correlation coefficient between different characters in Chickpea genotype

Traits	Days to 50% flowering	Days to maturity	Plant height (cm)	Ground Clearance (cm)	No. of pods/plants	Grain yield/plant (g)	100-Seed weight (g)	Yield/plot (g)
Days to 50% flowering	0.13953	-0.00091	0.01402	-0.12002	0.00505	0.00596	0.05015	0.09378
Days to maturity	0.01574	-0.00803	-0.04067	-0.03026	0.02117	0.01849	0.03666	0.0131
Plant height (cm)	0.00421	0.00070	0.46427	-0.30050	-0.01608	-0.00607	-0.20752	-0.06099
Ground Clearance (cm)	0.03786	-0.00055	0.31538	-0.44237	0.00194	-0.00070	-0.16464	-0.25308
No. of pods/plant	-0.00597	0.00144	0.06328	0.00725	-0.11800	--0.04034	-0.08865	-0.10031
Grain yield/plant (g)	- 0.00520	-0.00093	-0.01764	0.00195	0.02978	0.15984	0.04049	0.20829
100-Seed weight (g)	-0.01934	0.00081	0.26626	-0.20128	-0.02891	-0.01789	-0.36185	-0.3622

Table.5 Genotypic Path coefficient between different characters of Chickpea genotypes towards yield.

Traits	Days to 50% flowering	Days to maturity	Plant height (cm)	Ground Clearance (cm)	No. of pods/plant	Grain yield/plant (g)	100-Seed weight (g)	Yield/plot (g)
Days to 50% flowering	1 **	0.1128 NS	0.0302 NS	0.2713 *	-0.0428 NS	0.0373 NS	-0.1386 NS	0.0938 NS
Days to maturity		1 **	-0.0876 NS	0.0684 NS	-0.1794 NS	0.1157 NS	-0.1013 NS	0.0131 NS
Plant height (cm)			1 **	0.6793 **	0.1363 NS	-0.038 NS	0.5735 **	-0.061 NS
Ground Clearance (cm)				1 **	-0.0164 NS	-0.0044 NS	0.455 **	-0.2531 *
No. of pods/plant					1 **	-0.2524 *	0.245 *	-0.181 NS
Grain yield/plant (g)						1 **	-0.1119 NS	0.2187 NS
100-Seed weight (g)							1 **	-0.3622 **
Yield/plot (g)								1 **

Table.6 Phenotypic Path coefficient between different characters of Chickpea genotypes towards yield.

Traits	Days to 50% flowering	Days to maturity	Plant height (cm)	Ground Clearance (cm)	No. of pods/plant	Grain yield/plant (g)	100-Seed weight (g)	Yield/plot (g)
Days to 50% flowering	0.95260	-0.02331	0.00648	-0.74077	0.03155	0.01472	-0.05639	0.18488
Days to maturity	0.52545	-0.04225	-0.16923	-0.32138	0.55385	0.18072	-0.33967	0.38749
Plant height (cm)	0.00789	0.00914	0.78275	-1.73539	-0.10795	-0.01845	0.33158	-0.73043
Ground Clearance (cm)	0.34113	-0.00656	0.65667	-2.06861	-0.03721	-0.00283	0.29799	-0.81942
No. of pods/plant	-0.10962	0.08537	0.30824	-0.28077	-0.27414	-0.21806	0.12952	-0.35946
Grain yield/plant (g)	0.03643	-0.01983	-0.03751	0.01518	0.15526	0.38503	-0.04742	0.48714
100-Seed weight (g)	-0.13301	0.03554	0.64269	-1.52638	-0.08792	-0.04521	0.40385	-0.71044



Fig. 01 Field view of Chickpea Breeding farm of ICAR-Indian Institute of Pulses Research, Kanpur



Fig. 02 Field view of trial, while taking phenological data

Days to 50% flowering showed a positive direct effect on yield per plot (0.1395), though its indirect effect via ground clearance was negative (-0.1200). Days to maturity exerted a small negative direct effect (-0.0080) with minor indirect contributions through pods per plant (0.0212). Plant height had a moderate positive direct effect (0.4643) but negative indirect effects via ground clearance (-0.3005) and seed weight (-0.2075). Ground clearance itself showed a large negative direct effect (-0.4424), reducing yield. Number of pods per plant had a negative direct effect (-0.1180) and indirect negative effects via grain yield (-0.0403). Grain yield per plant exerted a positive direct effect (0.1598) and contributed indirectly to plot yield (0.2083). Conversely, 100-seed weight showed a negative direct effect (-0.3619) and reduced yield per plot (-0.3622), see *Table 06*.

The present study on chickpea genotypes demonstrated significant genetic variability and trait associations, providing valuable insights for breeding and agricultural improvement. ANOVA confirmed strong treatment effects with minimal environmental influence, validating experimental precision. High heritability and genetic advance for days to 50% flowering, 100-seed weight, and grain yield per plant highlight these traits as reliable targets for direct selection. Correlation analysis revealed complex interrelationships, including positive associations of plant height with seed weight and negative trade-offs between seed size and plot yield. Path coefficient analysis further clarified causal relationships, identifying grain yield per plant as the most consistent trait exerting a positive direct effect on plot yield. Overall, the integration of variability, correlation, and path analysis underscores the importance of selecting genotypes with early flowering, moderate plant height, balanced seed size, and stable grain yield per plant to achieve sustainable productivity and support mechanical harvesting in chickpea breeding (*Moulya et al., 2024 and Prathyusha et al., 2024*).

Authors' Contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Competing Interests

All the authors have declared that no competing interests exist.

References

- Al-Ji-bouri, H. A.; Miller, P. A. and Robinson, H. A. (1958). Genotypic and environment variances and covariance in an upland cotton cross of inter specific origin, *Agron. J.* 50: 633–636. <https://doi.org/10.2134/agronj1958.00021962005000100020x>
- Alka Yadav, Noopur Singh, Shashi Kant, Anukool Kumar (2025). Correlation and Path Coefficient Analysis for Yield and Its Component Traits in Chickpea (*Cicer arietinum* L.) *International Journal of Advanced Biochemistry Research*, 9(7): 1762–1764.
- Ayyala Prathyusha, Devarakonda Uday Kiran Kumar, Shama Parveen (2024). Genetic Variability, Heritability, Genetic Advance for Yield and Yield Related Attributes in Chickpea (*Cicer arietinum* L.) *Environment and Ecology*, 42(1A): 332–334.
- Burton, G. W. and de Vane, E. W. (1952). Estimating heritability in tall fescue (*Festuca arundinacea*) from replicated clonal material. *Agron J.* 45: 478–481. <https://doi.org/10.2134/agronj1952.00021962004400100005x>
- Dewey, D. R. and Lu, K. H. (1959). A correlation and path coefficient analysis of component of crested wheat grain production. *Agron. J.*, 51: 515–518. <https://doi.org/10.2134/agronj1959.00021962005100090002x>
- FAO Stat. (2024). <https://www.fao.org/faostat/en/#home>
- G. Anil Kumar, G.M. Lal, P.K. Rai (2022). Estimation of Genotypic Variability and Path Coefficient in Chickpea. *Quest Journals: Journal of Research in Agriculture and Animal Science*, 9(9): 70–80.

- Hanson, C. H., Robinson, H. F., and Comstock, R. E. (1956). Biometrical studies of yield in segregating population of Korean lespedeza 1 *Agronomy journal*, 48(6): 268-272. <https://doi.org/10.2134/agronj1956.00021962004800060008x>
- Jain S.K., Sharma L.D., Gupta K.C., Kumar Vipen, Yadav M.R. (2023). Variability and Character Association for Yield and Quantitative Traits under Late Sown Conditions in Chickpea (*Cicer arietinum* L.). *Legume Research*, 46(4): 408–412. <https://doi.org/10.18805/LR-4734>
- Johnson, K. F., Robinson, H. F. and Comstock, R. E. (1955). Genotypic and phenotypic correlation in soyabean and their implication in selection. *Agron. J.*, 47: 477-483. <https://doi.org/10.2134/agronj1955.00021962004700100008x>
- Manne Bharath, Ashmi A., Gabriel Michael Lal (2025). Evaluation of Genetic Variability, Heritability and Trait Interrelationships in Chickpea for Yield Enhancement. *International Journal of Agriculture and Food Science*, 7(8): 1432–1441.
- Moulya G., Harish Babu B.N., Lakshmana D., Dhananjaya B.C., Raghavendra S. (2024). Studies on Genetic Variability and Character Association in Chickpea Germplasm for Growth and Yield Attributes. *Journal of Advances in Biology & Biotechnology*, Vol. 27(10); 1119-1125, 2024; ISSN: 2394-1081. <https://doi.org/10.9734/JABB/2024/v27i101530>
- Nandan Kumar, Shan Hong, Yi Zhu, Antonio Garay, Jun Yang, Douglas Henderson, Xin Zhang, Yixiang Xu, Yonghui Li (2025). Comprehensive Review of Chickpea (*Cicer arietinum*): Nutritional Significance, Health Benefits, Techno-functionalities, and Food Applications. *Comprehensive Reviews in Food Science and Food Safety*.
- P. Renukadevi, B. Subbalakshmi (2026). Correlations and Path Coefficient Analysis in Chickpea Legume Research, 29(3): 201–204.
- Patil C.R., A.M. Patil, S.B. Khairnar and D.A. Patil (2024). Chickpea (*Cicer arietinum* L.): Origin and Domestication in Historical Perspective. *Journal of Emerging Technologies and Innovative Research*, Volume 13, Issue 3, ISSN: 2349-5162, November 2024.
- Prasenjit Paul, S. S. Patil and N. Manojkumar Mukul Gandhi (2022). Study of Correlations and Path Evaluations to Find Yield Contributing Characters in Chickpea Genotypes. *International Journal of Environment and Climate Change* 12(8): 83-90, 2022; ISSN: 2581-8627. <https://doi.org/10.9734/IJECC/2022/v12i830717>
- Teena Patel, Anita Babbar, Kumar Jai Anand, Monika Patel, Yogendra Singh, Vijay Kumar Katara (2025). Assessment of Genetic Variability and Trait Performance in Chickpea (*Cicer arietinum* L.) under Diverse Environmental Conditions. *International Journal of Advanced Biochemistry Research*, 9(7): 1161–1167.
- VB Bhor, DB Lad, AA Bhagat, MR Bhakare (2025). Correlation and Path Analysis in Chickpea (*Cicer arietinum* L.) Genotypes under Late Sown Condition. *International Journal of Statistics and Applied Mathematics*, SP-10(2): 01–05.

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