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Comparative Study on Hybrid and Traditional Seed Cultivars of Finger millet (*Eleusine coracana* L.)

M. A. Yogeshwari[1], M.M. Kalpashree[2], D. Yashwanth[3], Dr. K. Krishna[4]
[1]*Research Scholar,* [2]*Faculty ,*[3]*Student,* [4]*Professor, Post Graduate Department of Botany, Yuvaraja's College, University of Mysore, Mysuru, 570005, Karnataka*

Abstract: ***Four cultivars of finger millet were taken in study, two were hybrid cultivars (KMR-340 and MR-6) and other two were traditional cultivars (MR-1 and GPU-28). Tests have been conducted for this study such as germination test, estimation of chlorophyll, total protein, total phenols, enzymatic activity and phytochemical analysis. The results revealed that highest rate of germination percentage and vigour index in hybrid cultivar i.e., MR-6 it has 86% of germination on 14th day. Chlorophyll content also high in MR-6 (0.075 mg/g) on 14th day. Total protein content was more in hybrid cultivars KMR-340 (145 mg/g) on day 14th than traditional cultivars. Whereas enzymatic activity and total phenol content was highest in traditional cultivars.***
Keywords: Finger millet cultivars, Germination, Vigour, Protein, Phenol, Enzymes, Phytochemicals.

I. INTRODUCTION

Agriculture is a critical activity in many regions of the world, particularly in developing countries, for ensuring appropriate nutrition and economic growth. The nutritional profile of finger millet is outstanding, covering all of the important macronutrients and micronutrients**.** Finger millet (*Eleusine coracana* L.) considered an ancient grain, is commonly known as ragi extensively cultivated in different region of India, Nigeria, Asian and African countries [1]. Ragi is a small seeded, round whole grain, seed coat rich in phytochemicals. Seeds used for human consumption, livestock and bird feed. It has multiple advantages over other crops, including drought and pest resistance [2]. The major finger millet growing states in India are Karnataka, Uttarakhand, Maharashtra, Tamil Nadu, Odisha, Andhra Pradesh and Gujarat. Finger millet is a crop of tropical and subtropical climate and can be cultivated up to an altitude of 2100 m. Finger millet can be grown on a wide adaptability to different soil, the best soil is alluvial, loamy and sandy soil with good drainage (ICMR 2021).

Grains are rich in minerals and are the richest source of calcium, iron, protein, fibre and other minerals and is a gluten (elastic texture) free food. It has low fat content and contains mainly unsaturated fat. Due to rich fibre content finger millet is believed to be a good laxative and prevents constipation. It is a good food for people who suffering from diabetes, liver diseases, high blood pressure, heart weakness and asthma [3]. Its green straw is suitable for making silage. The current study aims to show difference between hybrid and traditional cultivar of finger millet.

II. MATERIALS AND METHODS

A. *Collection of Samples*

The study was conducted at Department of Botany, Yuvaraja's College Mysore, Mysuru. This was carried out for a period of four months. 4 different varieties of finger millet were collected among them 2 were hybrid cultivars (KMR-340 & MR-6) and other 2 were traditional cultivars (MR-1 and GPU-28). Seeds were collected from ICAR- Krishi Vigyan Kendra, Ramanagara. University of Agricultural Sciences, Bengaluru

B. *Germination Percentage and Vigour Index*

Paper towel method was used for calculation of germination percentage by using the formula according to ISTA,2003. The Seedling Vigour Index was calculated by using the formula and expressed in whole number [4]. Root length and Shoot length from each seed was measured and total sum of the root length and shoot length (mean seedling length) was calculated.

$$\text{Germination percentage} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds sown}} \times 100$$

Vigour Index = Percentage of Germination X Mean seedling length

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C. Chlorophyll Test

The chlorophyll contents viz. chlorophyll-a and chlorophyll-b and total chlorophyll were estimated as per the standard method by [4] and calculated using following formula.

$$\text{mg chlorophyll a/g tissue} = 12.7\,(A_{663}) - 2.69\,(A_{645}) \times \frac{V}{1000 \times W}$$

$$\text{mg chlorophyll b/g tissue} = 22.9\,(A_{645}) - 4.68\,(A_{663}) \times \frac{V}{1000 \times W}$$

and $$\text{mg total chlorophyll/g tissue} = 20.2\,(A_{645}) + 8.02(A_{663}) \times \frac{V}{1000 \times W}$$

where A = absorbance at specific wavelengths

V = final volume of chlorophyll extract in 80% acetone

and W = fresh weight of tissue extracted

D. *Estimation of Total Protein and Total Phenol*

The Total protein and Total phenol content of rice seedling was estimated as per the standard procedure [6], [7].

E. Estimation of Enzymes

Extraction of enzymes-100 mg seed or seedling or root or shoot sample in a mortar with 1 ml 0.02M phosphate buffer and the extract was spun at low speed (10,000 rpm for 20 min). The supernatant homogenate was used for enzyme assay. α – Amylase and β - Amylase content was determined as per the procedure described [8].

F. Phytochemical analysis

Phytochemical examination was carried out for all the extract as per the standard methods described [9]. Phytochemical analysis of crude extract of flour of finger millet in different solvents (Acetone and Petroleum ether) was carried out using standard protocol, confirms the presence of various phytochemical constitutes.

III. RESULTS AND DISCUSSION

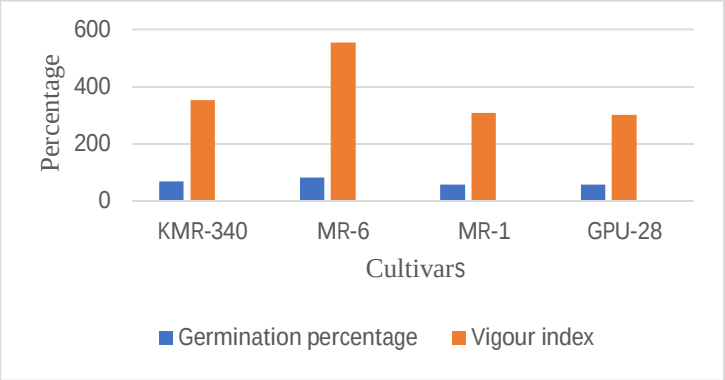
A. Germination Percentage and Vigour Index

The results of ANOVA did show significant difference on germination percentage and vigour index. On both 5th and 14th day of germination MR-6 hybrid cultivar showed the maximum germination percentage and vigour index. But GPU- 28 showed less germination percentage. Some other review showed decrease in germination percentage was related to chromosomal aberration that occur under long storage condition [10].

Table-1: 5th day ragi seedling showing germination percentage and vigour index.

Cultivars	Germination percentage (%)	Vigour index
KMR-340	68^{b}	352^{b}
MR-6	82^{a}	554^{a}
MR-1	58^{c}	308^{c}
GPU-28	56^{c}	300^{c}
F- value	424	2412

Mean value followed by the same letter within a row are not significantly different as indicating by Tukey's ($P \leq 0.05$) significantly at $P \leq 0.001$.

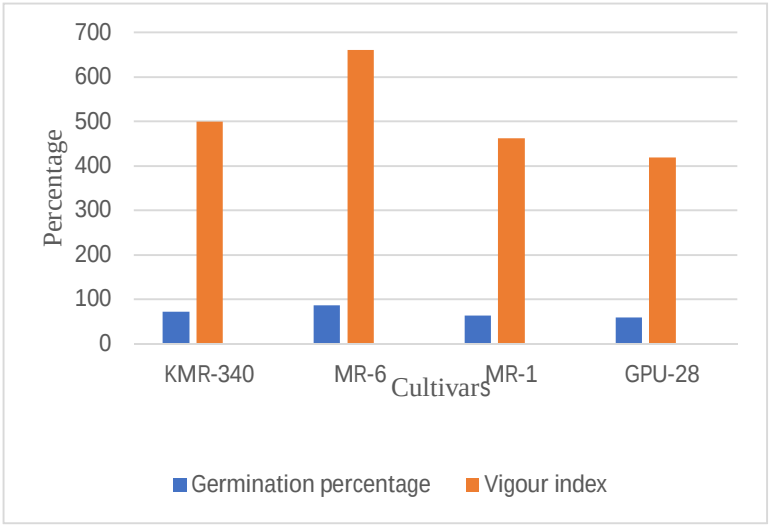


Graph-1: 5th day ragi seedling showing germination percentage and vigour index.

Table-2: 14th day ragi seedling showing germination percentage and vigour index

Cultivars	Germination percentage (%)	Vigour index
KMR-340	71[b]	499[b]
MR-6	86[a]	660[a]
MR-1	63[c]	461[c]
GPU-28	59[d]	419[d]
F- value	436	4427

Mean value followed by the same letter within a row are not significantly different as indicating by Tukey's ($P \leq 0.05$) significantly at $P \leq 0.001$.



Graph-2: 14th day ragi seedling showing germination percentage and vigour index.

B. Chlorophyll Content

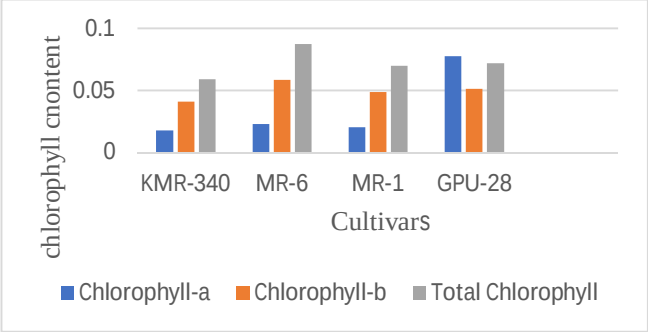
Chlorophyll content shown in table no 3 results that compare to other cultivars of ragi as indicated by Tukey's method of analysis, more chlorophyll present in MR-6, this indicates that MR-6 cultivar was more resistant to microbes. The ability to synthesize more chlorophyll under stress is a good criterion for more species tolerant to drought [11]. But KMR-340 have less chlorophyll content. Finger millet genotype showed minimum decrease in chlorophyll content during any stress condition [12].

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Table-3: 5th day ragi seedling showing chlorophyll content.

Cultivars	Chlorophyll-a (mg/g)	Chlorophyll-b (mg/g)	Total Chlorophyll (mg/g)
KMR-340	.0177[c]	.0410[c]	.0590[c]
MR-6	.0230[b]	.0587[a]	.0873[a]
MR-1	.0203[b]	.0487[b]	.0697[b]
GPU-28	.0777[a]	.0513[b]	.0720[b]
F- value	1	70	140

Mean value followed by the same letter within a row are not significantly different as indicating by Tukey's ($P \leq 0.05$) significantly at $P \leq 0.001$.

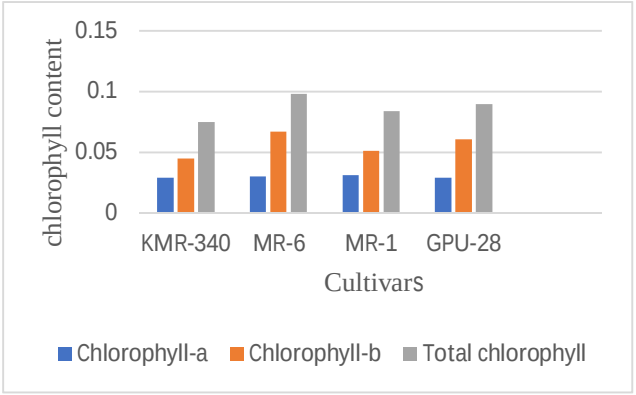


Graph -3: 5th day ragi seedling showing chlorophyll content.

Table-4: 14th day ragi seedling showing Chlorophyll content.

Cultivars	**Chlorophyll-a (mg/g)**	**Chlorophyll-b (mg/g)**	**Total Chlorophyll (mg/g)**
KMR-340	.0290[c]	.0447[d]	.0750[d]
MR-6	.0303[b]	.0670[a]	.0980[a]
MR-1	.0310[a]	.0513[c]	.0840[c]
GPU-28	.0290[c]	.0607[b]	.0900[b]
F- value	2	146	282

Mean value followed by the same letter within a row are not significantly different as indicating by Tukey's ($P \leq 0.05$) significantly at $P \leq 0.001$.



Graph-4: 14th day ragi seedling showing Chlorophyll contents.

C. Estimation of Total Proteins

The Total Protein content in both traditional and hybrid cultivars i.e., in KMR-340, MR-6, MR-1, and GPU-28 was increased from 5th to 14th day. KMR-340 was recorded as highest protein content on both day 5 and day 14, whereas MR-1 was recorded as lowest protein content. As compared with the traditional cultivars, the hybrid cultivars showed the highest protein content. Some literature showed increase in protein content on germination and considered synthesis of enzyme protein, imbibition and degradation of other constituents as the major reason for increase in protein content [13].

D. Estimation of Total Phenols

Estimation of total phenol revealed that the phenol content was increased in both traditional and hybrid cultivars from day 5th to 14th day. GPU-28 showed highest concertation of phenol in day 5th and gradually increases till 14th day also, KMR-340 was recorded as lowest concentration of phenol on both the day. Other study showed total phenol content in non-germinated finger millet grains was 1.50%, which decreased to 0.490% after 24h of germination. However, prolonged germination time increased the phenol content [14]. As compared with the hybrid cultivars, the traditional cultivars showed the highest phenol content.

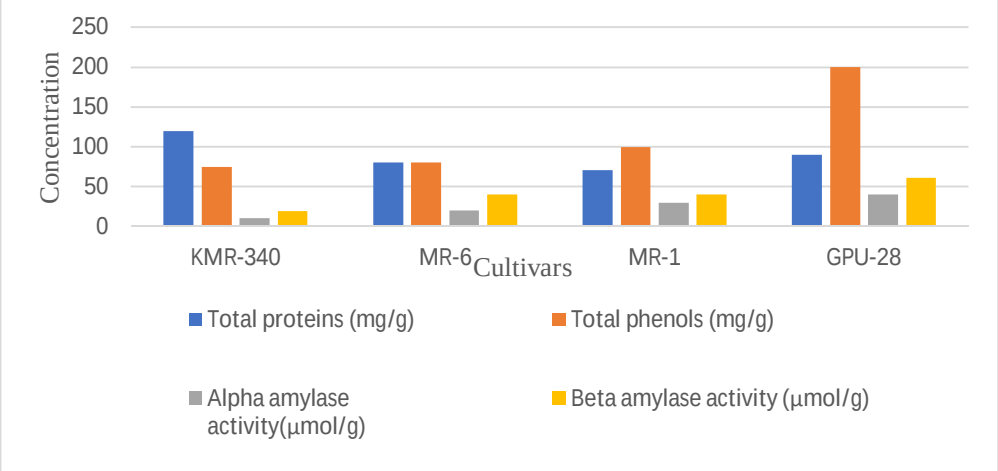
E. Enzyme Estimation

Estimation was carried out in finger millet cultivars, a significant difference in amylase activity was recorded. GPU-28 had maximum alpha and beta amylase activity both on 5th and 14th day when compared to other finger millet cultivars. The highest alpha amylase activity was exhibited in malt flour of ragi germinated for 9 days and 6 days, while the highest beta amylase activity was displayed in malt flour germinated for 5 days [15]. This estimation showed highest amylase activity in traditional cultivar when compared to hybrid cultivar

Table-5: Estimation of total protein, total phenol and enzyme activity on 5th day ragi seedlings.

Cultivars	Total proteins (mg/g)	Total phenols (mg/g)	Alpha amylase activity(µmol/g)	Beta amylase activity (µmol/g)
KMR-340	120^{a}	75^{c}	10^{c}	19^{c}
MR-6	80^{b}	80^{bc}	20^{bc}	40^{b}
MR-1	70^{b}	99^{b}	30^{b}	40^{b}
GPU-28	90^{b}	200^{a}	40^{a}	61^{a}
F- value	15	190	29	48

Mean value followed by the same letter within a row are not significantly different as indicating by Tukey's ($P \leq 0.05$) significantly at $P \leq 0.001$.

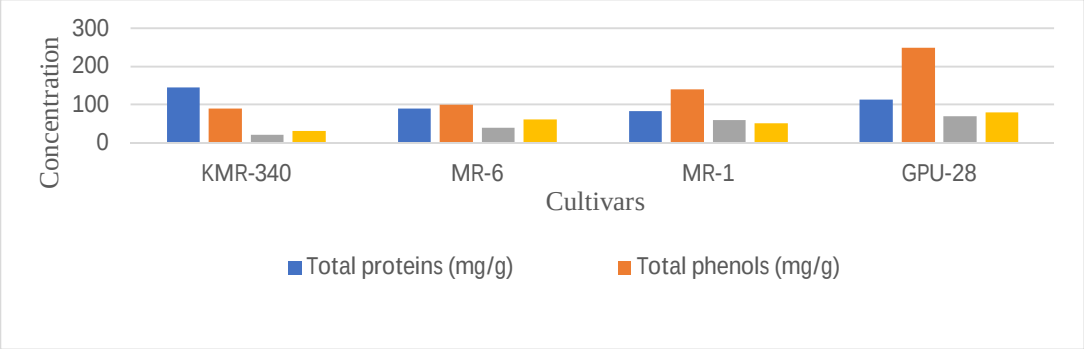


Graph-5: Estimation of total protein, total phenol and enzyme activity on 5th day seedling.

Table-6: Estimation of total protein, total phenol and enzyme activity on 14th day ragi seedling.

Cultivars	Total proteins (mg/g)	Total phenols (mg/g)	Alpha amylase activity(µmol/g)	Beta amylase activity (µmol/g)
KMR-340	145^{a}	90^{c}	19^{c}	30^{c}
MR-6	$89b^{c}$	99^{c}	38^{b}	60^{b}
MR-1	82^{c}	140^{b}	59^{a}	50^{b}
GPU-28	112^{b}	249^{a}	70^{a}	80^{a}
F- value	25	509	33	50

Mean value followed by the same letter within a row are not significantly different as indicating by Tukey's ($P \leq 0.05$) significantly at $P \leq 0.001$.



Graph-6: Estimation of total protein, total phenol and enzyme activity on 14th day ragi seedling.

F. Phytochemical Examination

Both petroleum ether and acetone extract of KMR-340, MR-6, MR-1, GPU-28 cultivar of ragi flour showed the presence of phytochemicals such as triterpenoids, saponin, glycosides, proteins and steroids compounds.

Table-7: Phytochemical analysis of finger millet flour extract.

SL No.	Test conducted	KMR-340	MR-6	MR-1	GPU-28
1	Triterpenes	+	+	+	+
2	Saponin	+	+	+	+
3	Alkaloids	-	-	-	-
4	Tannins	-	-	-	-
5	Flavonoids	-	-	-	-
6	Resin	-	-	-	-
7	Glycosides	+	+	+	+
8	Protein	+	+	+	+
9	Steroids	+	+	+	+
10	Carbohydrates	-	-	-	-

IV. CONCLUSION

From the result we can conclude that hybrid cultivars have good germination capacity hence give more yield and production when compare to traditional cultivars of finger millet, but traditional cultivars show more enzymatic activity and defence response. So, from the study we can conclude that for better yield we must select hybrid cultivar and for good defence response we should select traditional cultivars.

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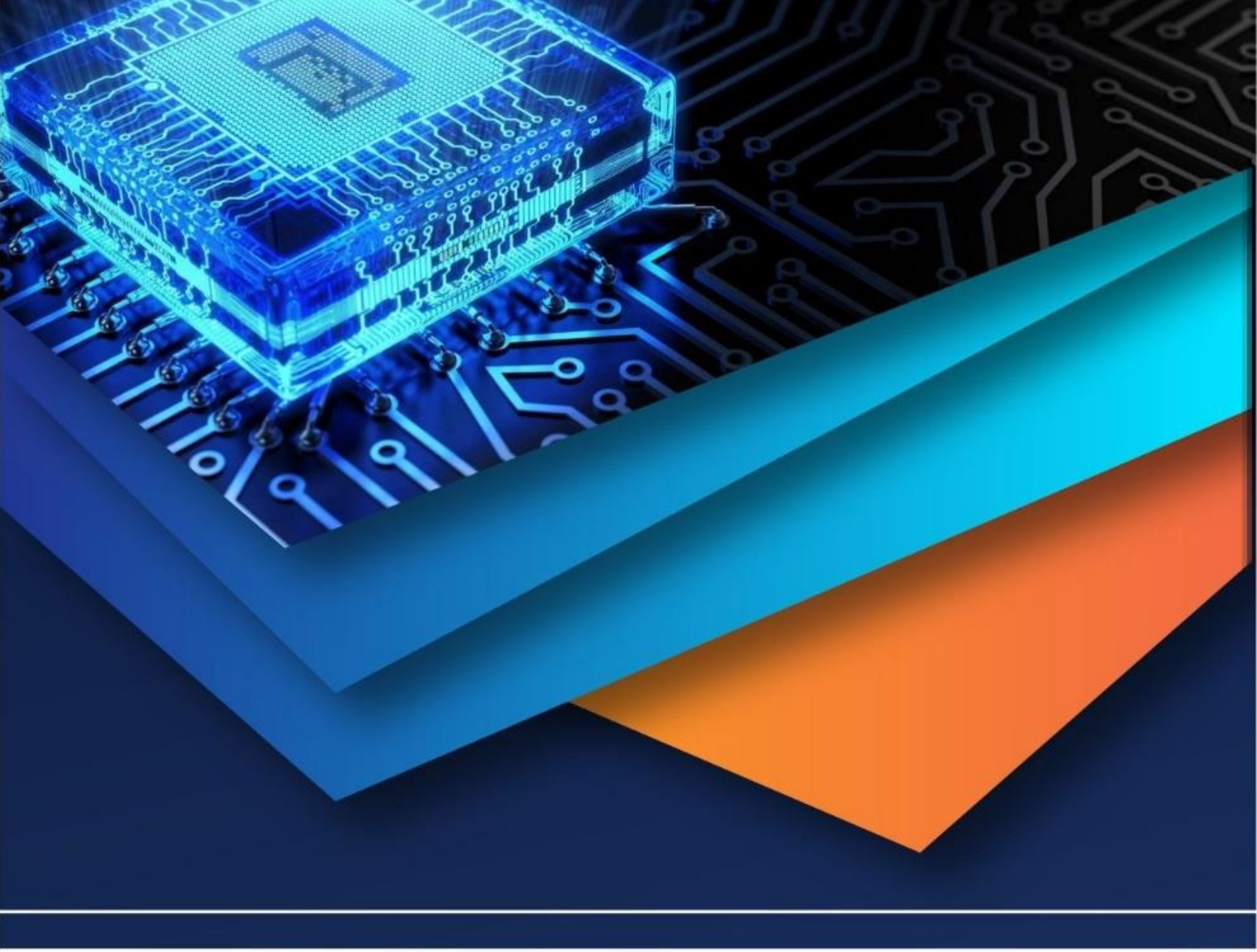
V. ACKNOWLEDGEMENT

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