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MORPHO-PHYSIO CHARACTERS STUDY, BIOCHEMICAL AND CALYX GROWTH YIELD VARIATION OF ROSELLE (*HIBISCUS SABDARRIFFA* L.)

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ABSTRACT

Roselle (*Hibiscus sabdarriffa L.*), an annual plant belongs to genus *Hibiscus*. It is important tropical and subtropical crop belongs to the family Malvaceae. Roselle grown in India mostly for the fiber and calyx yield. Current experiment was conducted during *Kharif 2023* with the following objectives to study the variation in calyx growth and yield. Five genotypes were assessed in four replications for physiological analysis of calyx growth and biochemical status. Among these, genotype AMV-5 exhibited the highest plant height, number of branches, and maintained superior fresh and dry weights of flowers. Additionally, AMV-5 outperformed the other genotypes in terms of fresh and dry weight of calyx and calyx volume per flower bud. Genotype RIN-90 demonstrated a higher number of leaves and leaf area (dm^2) at 50% flowering, along with improved performance in calyx growth and yield. Based on physiological and biochemical variations observed, genotype AMV-5 is recommended for its highest fresh and dry calyx weight per plot and total dry matter (g/m^2). Furthermore, genotype BRRM-1 displayed significantly elevated phenolic content, followed closely by AMV-5, suggesting its high medicinal value. For earliness and overall calyx productivity, genotype RIN-90 is recommended for cultivation by farmers.

Keywords **:** Growth, calyx, dry matter, light intensity, chlorophyll, phenolic.

Introduction

Roselle (*Hibiscus sabdarriffa L.*), an annual plant belongs to genus *Hibiscus*. It is important tropical and subtropical crop belongs to the family Malvaceae. Roselle grown in India mostly for the fiber and calyx yield. Roselle is a tetraploid (2n = 4x = 72) (Wilson and Menzel, 1964), annual and flowering plant (Javadzadeh *et al*. 2014). Roselle has more than 300 species cultivated in Mexico, parts of Central America, the West Indies, and in Southern Florida, Texas and California in the late Nineteenth-century. In India roselle is also known by various local names such as Ambadi (Marathi), Ronga Ambal (Bengali), Gongura (Hindi), Mukkalli (Kannada), etc. Roselle was also called as Jamaican sorrel in Jamaica, Karkade in Sudan, Bissaya in Philippines and Yam Muan in Thailand.

Roselle is an annual herbaceous plant with high calyx and fiber yield. The plants are normally non branching and attain a height of nearly 3 to 3.5 meter with a basal diameter of 1.0 to 2.0 cm. The leaves in roselle are generally palmate, deeply lobed and alternately borne on the stem. The arrangement of leaves is alternate means each leaf is situated at a different point along stem (Zhen *et al.*, 2016). The flowers typically have five large petals have cream to light yellow or pale pink flowers, having a scarlet to magenta throat and a green or slightly reddish stem depending on the variety.

The calyx is a prominent, fleshy and brightly coloured structure surrounding the flower. It consists

of sepals that are fused together to form a cup like shape. The calyx typically vibrant red or purple but it also found in other colours depending on varieties. The intense colour is due to presence of anthocyanins. The fruit is a capsule which is 1.8-2.5 cm long and 1.2-2 cm in diameter is hairy and comprise of five segments. The seeds are brown coloured, globous, wedge shaped 4-6 mm in size. Roselle has prolific root system with taproot and lateral roots which is helpful in soil water and plant nutrient absorption (Mara *et al.*, 2020).

Roselle gaining importance in the manufacture of many small industries. e. g. cosmetics, sweets, sauces, jams, and jellies and a substitute for tea and also used as a coloring material for food. The fleshy calyces of roselle have been used in various countries as food or a food ingredient such as jellies, syrups, beverages, puddings, cakes, and wines (Christian *et al.*, 2006). It is also used in medicine, especially with problems related to the digestive tract (El Naim *et al.,* 2012). Many parts of roselle including roots, stem, leaves, seeds, flowers and fruits are used in various foods. The phytochemical compounds found in roselle leaves include polyphenols neochlorogenic acid, chlorogenic acid, cryptochlorogenic acid, quercetin, kaempferol and their glycosides, and 5-(hydroxymethyl) furfural (Villani *et al*., 2013).

The growth and yield of roselle calyces are critical factors in the successful cultivation of this versatile plant. Understanding the key aspects of calyx development, including the impact of environmental and management factors, can help optimize production and enhance the economic value of roselle. The growth of calyx yield is seen in between stage 6 to 8 of BBCH scale. Effective cultivation practices, coupled with favorable growing conditions, lead to high-quality and high-yielding roselle crops. In view, the experiment was conducted during *Kharif 2023* with the following objectives to study the variation in calyx growth and yield.

Materials and Methods

Experimental site

The experiment was conducted at Post Graduate Institute farm, MPKV, Rahuri, Dist.: Ahmednagar during the main cropping season in *kharif*-2023. The description of the test environments is shown in Table 1.

Table 1: Description of the test environments testing location

Testing location	Altitude (m.a.s.l)	Latitude	Longitude	Annual Rainfall (mm)	Min. annual Temp.(°C)	Max. annual Temp. (°C)
MPKV, Rahuri	511 meters	$19^0$38'N and $19^0$57' N	74°32'E and 74°19' E	548.20 mm	21.78°C	30.98°C

Experimental materials and design

Five genotypes of roselle viz. AHS-342, BRRM-1, HS-4288, RIN-90 and AMV-5 were evaluated in four replications for Physiological and biochemical variation for calyx growth and yield. The gross and net plot sizes were 3×3.30m^2. The spacing was 45×15 cm^2. The plot was manured by 1 ton of FYM ha^{-1} during land preparation and incorporated well with harrowing. The half dose Nitrogen (30 kg ha^{-1}) and full dose of P_2O_5 and K_2O (30 kg ha^{-1}) applied at the time of sowing. The remaining dose of Nitrogen was applied at 35 DAS and 65 days after sowing.

Data collection

The observations on growth and calyx yield parameters were recorded on 50% flowering and calyx maturity, Plant height (cm), Number of leaves $plant^{-1}$, Number of branches $plant^{-1}$, Leaf area (dm^2), Chlorophyll content (SPAD), Fresh weight of Flower (g), Dry weight of flower (g). Fresh weight of calyx/ m^2 (kg), Fresh weight of calyx $plot^{-1}$ (kg), Dry weight of calyx/ m^2 (g) and Dry weight of calyx $plot^{-1}$ (kg), Phenolic Content (mg GAE/gm) those parameters recorded at the time of harvest. Around 500 flower buds were tagged in each plot to record the observations on calyx growth and observations were recorded on fresh weight, dry weight and volume of the calyx periodically at 4 days interval until calyx maturity.

Data analysis

The data analyzed for growth rates as per the formulae;

Chlorophyll content measured by SPAD Chlorophyll Meter Reading.

Light Intensity measured by LUX meter.

Light Extinction Coefficient (K)

$$K = \frac{\log eI/I_0}{LAI}$$

Leaf Area Index

$$LAI = \frac{\text{Total leaf area of a plant}}{\text{Ground area occupied by the plant}}$$

Light Transmission Ratio

$$LTR = \frac{I}{I_0}$$

Total Dry Matter

$$\text{Total dry matter} = \frac{\text{Oven dry weight}}{\text{Fresh weight}} \times 100$$

Relative dry matter efficiency

$$\text{Relative dry matter efficiency} = \frac{\text{Total dry matter}}{\text{Days to maturity}} \times 100$$

(calyx)

Estimation of Phenols was carried out with Folin-Ciocalteu reagent by method of Bray and Thorpe (1954).

The data will be analyzed for coefficient of variation through randomized block design by Panse and Sukhatme (1985).

Results and Discussion

Growth and Yield Contributing Morphological Characters

The data on various growth and development characters, including plant height (cm), number of leaves per plant at 50% flowering, number of branches per plant at harvest, and leaf area (dm^3) at 50% flowering, indicate statistically significant differences among the all roselle genotypes for all morphological traits are presented in Table 2. According to Petrini et al. (1994), kenaf exhibits an indeterminate growth pattern, characterized by a rapid growth rate that peaks at the appearance of the first flower, followed by a gradual decline in growth thereafter.

The genotype, AMV-5 recorded the significantly the highest plant height (307.92 cm) and number of branches per plant at harvest. The genotype RIN-90 recorded significantly the highest number of leaves (118) and Leaf area (42.20) (dm^2) and HS-4288 recorded at par Leaf area at 50% flowering than rest of other genotypes.

Table 2: Morphological parameter influenced by roselle genotypes

Treatment	Plant height (cm) at harvest	No. of leaves/ plant at 50% flowering	No. of branches/ plant at harvest	Leaf Area (dm^2) at 50% flowering
AHS-342	216.50	94.00	9.50	21.80
BRRM-1	276.40	74.80	13.60	24.00
HS-4288	204.17	82.00	12.30	35.80
RIN-90	255.00	118.00	16.90	42.20
AMV-5	307.92	92.60	19.25	28.60
Mean	**252.00**	**92.28**	**14.31**	**30.48**
SE+	**7.874**	**3.003**	**0.470**	**1.136**
CD @5%	**24.251**	**9.253**	**1.450**	**3.500**

Calyx Growth

Fresh and Dry Weight of Flowers (gm)

The roselle flowers consists of five large petals with bright yellow or light pink colour. Flower having medium to large size varies with the genotype, climatic conditions and other cultivation practices.

Table 3: Fresh and dry weight of flower (gm) at initiation of flowering

Genotype	Fresh Weight of flower (gm)	Dry Weight of flower (gm)
AHS-342	2.28	0.26
BRRM-1	2.85	0.32
HS-4288	2.56	0.28
RIN-90	3.10	0.37
AMV-5	3.60	0.40
Mean	**2.88**	**0.33**
SE+	**0.09**	**0.01**
CD @5%	**0.29**	**0.03**

At the initiation of flowering, from the data, it was found that the mean fresh and dry weight of flower was 2.88 gm and 0.33 gm respectively. The genotype AMV-5 recorded significantly the highest fresh and

dry weight of flower followed by genotype RIN-90 and BRRM-1.

Fresh Weight of Calyx (gm)

The roselle calyx, which consists of fleshy sepals surrounding the fruit capsule, displays distinct colours, with some being crimson red and others reddish-green. Table 4 and Figure 1 present data on the fresh weight of the calyx across different roselle genotypes at various growth stages. The results indicate that calyx weight increased progressively with the plant's age. Statistically significant differences were observed among the genotypes regarding the fresh weight of the calyx at different growth stages.

Table 4: Fresh weight of calyx (g/flower bud) influenced by roselle genotypes at various stages of growth

Genotype	4 DAF	8 DAF	12 DAF	16 DAF	20 DAF	24 DAF	28 DAF
AHS-342	0.10	0.17	0.24	0.52	1.15	1.94	2.2
BRRM-1	0.19	0.30	0.42	0.95	1.90	2.65	2.98
HS-4288	0.12	0.18	0.23	0.49	1.65	2.35	2.65
RIN-90	0.21	0.32	0.70	1.20	2.34	3.15	3.55
AMV-5	0.30	0.40	0.98	1.57	2.56	3.68	3.91
Mean	**0.19**	**0.28**	**0.51**	**0.94**	**1.92**	**2.75**	**3.06**
SE+	**0.006**	**0.01**	**0.02**	**0.03**	**0.06**	**0.09**	**0.10**
CD @5%	**0.018**	**0.03**	**0.05**	**0.09**	**0.20**	**0.28**	**0.30**

In this study, genotype AMV-5 consistently exhibited the highest fresh weight, measured in grams, at various days after flowering (DAF): 0.30 at 4 DAF, 0.40 at 8 DAF, 0.98 at 12 DAF, 1.57 at 16 DAF, 2.56 at 20 DAF, 3.68 at 24 DAF, and 3.91 at 28 DAF. The genotype AHS-342 showed lowest fresh weight growth among all 5 roselle genotype. The increase in fresh weight was relatively gradual until 16 DAF, followed by a more rapid increase until 24 DAF, after which the growth rate slowed as the plants approached maturity.

The growth rate of fresh weight of calyx ultimately influences the final yield of calyx at harvest. The results of fresh weight of calyx were similar with the findings of Javadzadeh *et al.* 2018.

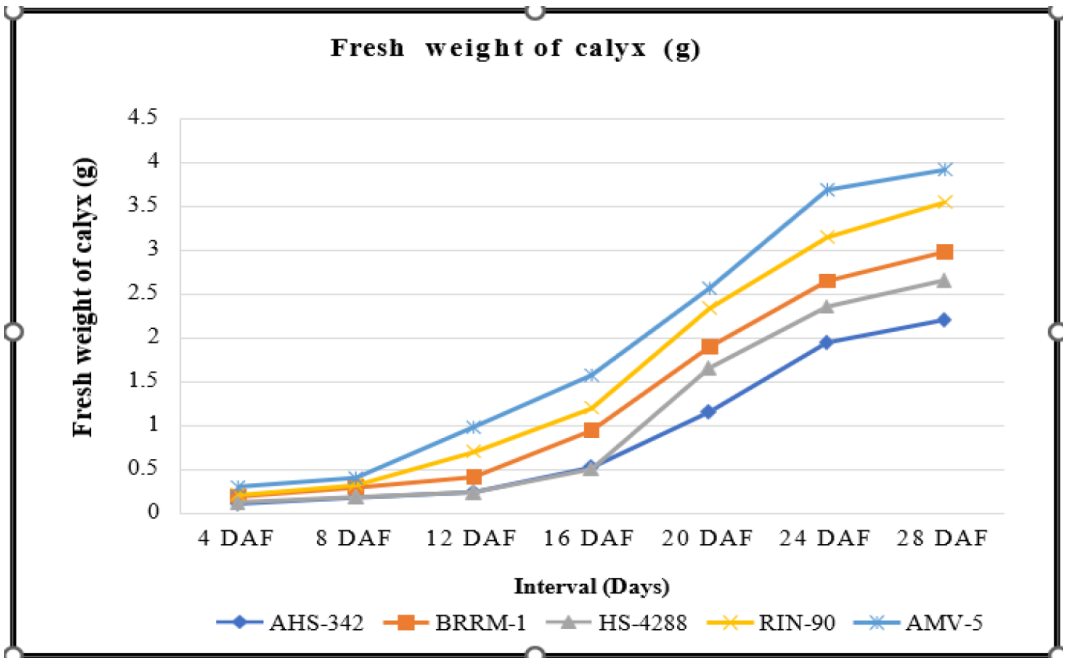

Fig. 1 : Fresh weight of calyx (g/flower bud) influenced by roselle genotypes at various stages of growth.

Dry weight of Calyx (gm)

The data on dry weight of calyx influenced by roselle genotypes at various stages of growth are presented in Table 5 and Figure 2. The results indicated that the dry weight of the calyx increased progressively with the advancing age of the crop. Statistically significant differences were observed among the genotypes regarding the dry weight of the calyx at various growth stages.

Table 5: Dry weight of calyx (g/flower bud) influenced by roselle genotypes at various stages of growth

Genotype	4 DAF	8 DAF	12 DAF	16 DAF	20 DAF	24 DAF	28 DAF
AHS-342	0.012	0.017	0.023	0.052	0.128	0.211	0.253
BRRM-1	0.022	0.030	0.044	0.100	0.218	0.262	0.342
HS-4288	0.014	0.017	0.030	0.080	0.186	0.256	0.291
RIN-90	0.024	0.032	0.057	0.120	0.266	0.337	0.390
AMV-5	0.032	0.045	0.074	0.137	0.250	0.412	0.453
Mean	**0.020**	**0.030**	**0.050**	**0.100**	**0.210**	**0.300**	**0.350**
SE+	**0.0006**	**0.001**	**0.002**	**0.003**	**0.007**	**0.010**	**0.011**
CD @5%	**0.002**	**0.003**	**0.005**	**0.010**	**0.022**	**0.030**	**0.034**

In this study, genotype AMV-5 consistently exhibited the highest dry weight per flower bud, measured in grams, at the following days after flowering (DAF): 0.032 at 4 DAF, 0.045 at 8 DAF, 0.074 at 12 DAF, 0.137 at 16 DAF, 0.250 at 20 DAF, 0.412 at 24 DAF, and 0.453 at 28 DAF. The genotype AHS-342 showed lowest dry weight of calyx among all 5 roselle genotypes. The increase in dry weight was relatively gradual until 16 DAF, followed by a more rapid increase until 24 DAF, after which the growth rate slowed as the plants approached maturity. The results of dry weight of calyx were similar with the findings of by Fakir *et al.,* 2012.

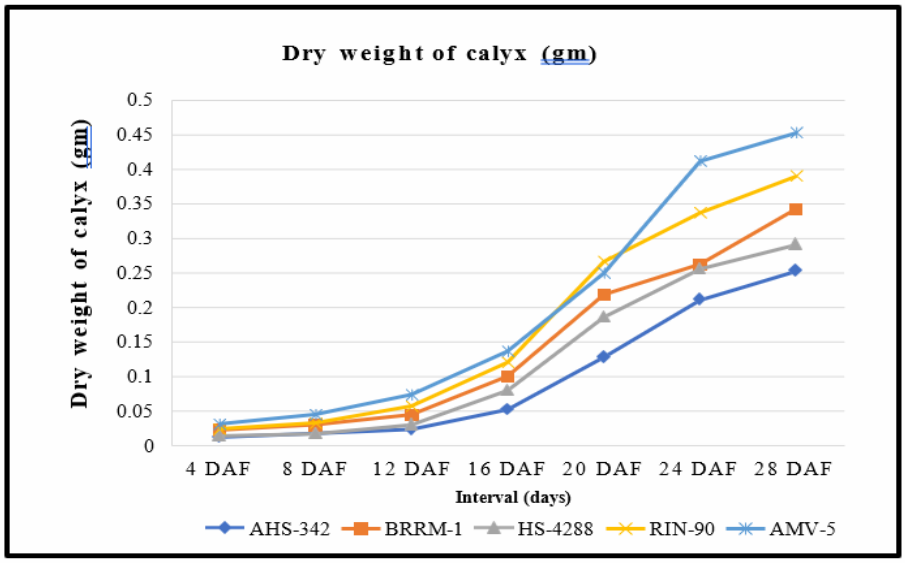

Fig. 2 : Dry weight of calyx (g/flower bud) influenced by roselle genotypes at various stages of growth.

Volume of Calyx (ml)

The data on volume of calyx influenced by roselle genotypes at various stages of calyx growth are presented in Table 6 and Figure 3. The results showed that the volume of the calyx increased progressively with the advancing age of the crop. Statistically significant differences were observed among the genotypes regarding the volume of the calyx at various growth stages.

Table 6: Volume of calyx (g/flower bud) influenced by roselle genotypes at various stages of growth

Genotype	4 DAF	8 DAF	12 DAF	16 DAF	20 DAF	24 DAF	28 DAF
AHS-342	0.10	0.17	0.22	0.45	1.05	1.80	2.05
BRRM-1	0.19	0.28	0.40	0.97	1.75	2.50	2.82
HS-4288	0.12	0.18	0.27	0.78	1.50	2.25	2.50
RIN-90	0.20	0.31	0.53	1.05	2.10	3.08	3.41
AMV-5	0.29	0.39	0.67	1.35	2.52	3.65	3.89
Mean	**0.18**	**0.26**	**0.42**	**0.92**	**1.78**	**2.66**	**2.94**
SE+	**0.006**	**0.008**	**0.01**	**0.03**	**0.06**	**0.09**	**0.10**
CD @5%	**0.018**	**0.025**	**0.04**	**0.10**	**0.18**	**0.27**	**0.29**

In this study, genotype AMV-5 consistently exhibited the highest calyx volume measured in millilitre, at the following days after flowering (DAF): 0.29 at 4 DAF, 0.39 at 8 DAF, 0.67 at 12 DAF, 1.35 at 16 DAF, 2.52 at 20 DAF, 3.65 at 24 DAF, and 3.89 at 28 DAF. In contrast, genotype AHS-342 displayed the lowest calyx volume among all five roselle genotypes. The rate of increase in calyx volume was relatively slow until 16 DAF, followed by a rapid increase until 24 DAF, after which the growth rate slowed as the plants approached maturity.

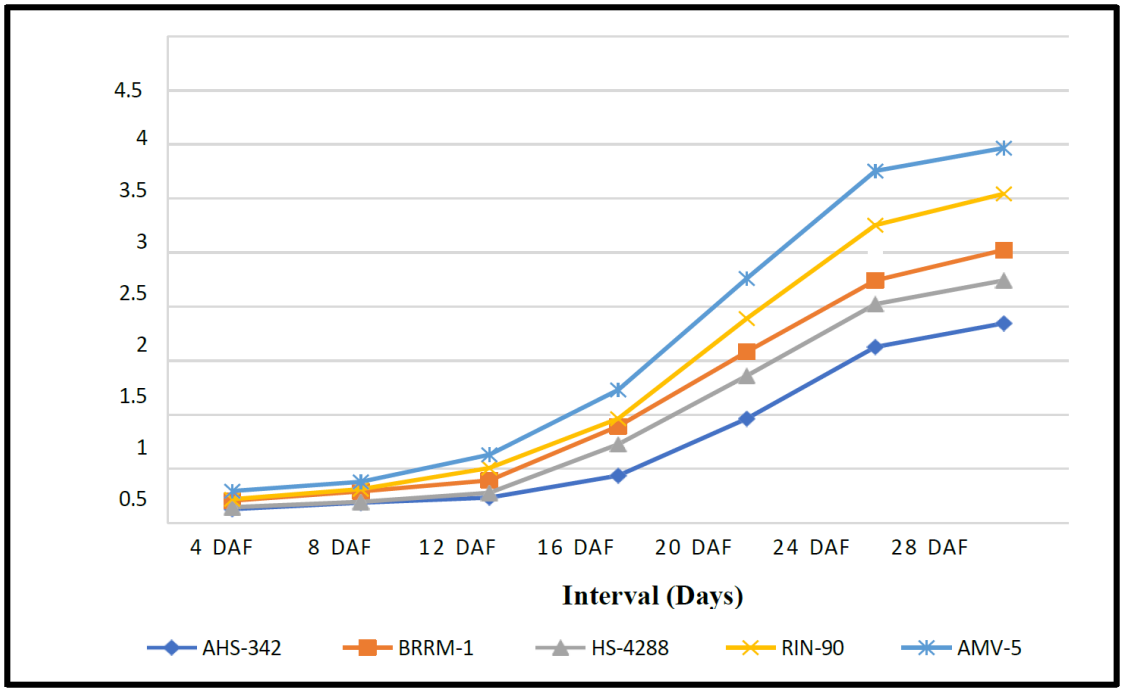

Fig. 3: Volume (ml/ flower bud) of calyx influenced by roselle genotypes at various stages of growth.

Physiological Parameters at 50% of Flowering

The physiological parameters measured at 50% flowering, including chlorophyll content, canopy temperature, and light intensity, are presented in Tables 7 and 8. The results indicate that there were statistically significant differences among the genotypes for all physiological parameters at this growth stage.

Chlorophyll Content (SPAD)

At 50% of flowering, SPAD chlorophyll meter readings for roselle genotypes ranged from 36.18 to 71.82, with a mean reading of 55.94. Genotype RIN-90 recorded the highest SPAD value, while genotype AMV-5 exhibited the lowest reading at 50% flowering.

Table 7: Chlorophyll content, canopy temperature influenced by roselle genotypes.

Genotype	Chlorophyll Content (SPAD)	Canopy Temperature (IRT)		
		Top	Middle	Bottom
AHS-342	69.80	35.10	30.20	27.30
BRRM-1	43.50	34.80	29.80	26.70
HS-4288	58.40	34.20	29.30	26.20
RIN-90	71.82	32.50	27.40	24.50
AMV-5	36.18	33.50	28.50	25.30
Mean	**55.94**	**34.02**	**29.04**	**26.00**
SE+	**1.99**	**1.14**	**0.98**	**0.88**
CD @5%	**6.14**	**3.46**	**2.99**	**2.65**

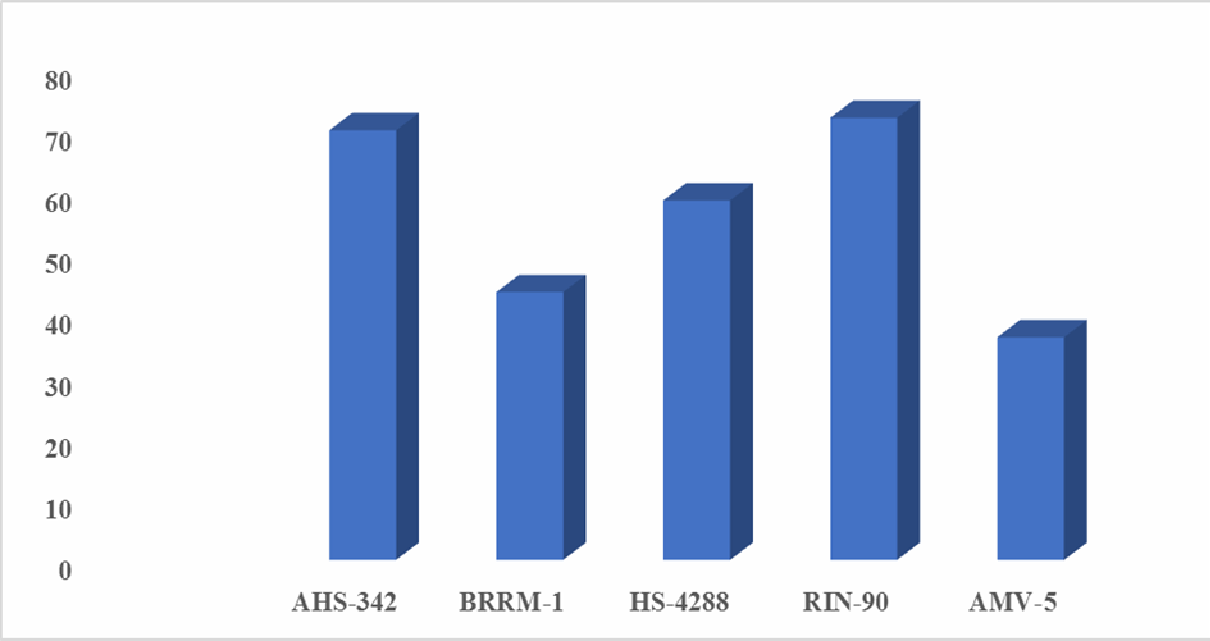

Fig. 4 : Chlorophyll content influenced by roselle genotypes

Canopy Temperature at Top, Middle and Bottom Level (IRT)

Liao *et al.* (2013) defined that the Canopy temperature is an integrative trait that reflects the plant water status or the resultant equilibrium between the root water uptake and shoot transpiration. At 50% of flowering, canopy temperatures at the top, middle, and bottom levels ranged from 24.50 to 35.1°C. The Genotype AHS-342 recorded significantly the highest canopy temperatures, while genotype RIN-90 had significantly the lowest temperatures at all three levels during 50% of flowering.

Light Intensity at Top, Middle and Bottom Level (Lux meter)

At 50% flowering, light intensity measured with a LUX meter ranged from 8,700 to 74,000 LUX at the top, middle, and bottom levels. Genotype AHS-342 exhibited significantly the highest light intensity, while genotype RIN-90 recorded the lowest readings across all levels.

Light Extinction Coefficient (K)

The mean light extinction coefficient (K) was 0.195. The Genotype AHS-342 had significantly the highest light extinction coefficient was 0.244, while genotype RIN-90 recorded significantly the lowest at 0.138 during 50% flowering.

Light Transmission Ratio

The mean light transmission ratio was 0.145. Genotype AHS-342 achieved the highest light transmission ratio at 0.162, while genotypes AMV-5 and RIN-90 both recorded the lowest ratio at 0.135 during the 50% of flowering.

Table 8 : Light intensity influenced by roselle genotypes

Genotype	Light Intensity (LUX Meter)			Light extinction coefficient (K)	Light transmission ratio
	Top	Middle	Bottom		
AHS-342	74000	39000	12000	0.244	0.162
BRRM-1	72000	37000	10900	0.230	0.151
HS-4288	71000	32000	10000	0.160	0.140
RIN-90	64000	26000	8700	0.138	0.135
AMV-5	67000	28000	9100	0.204	0.135
Mean	**69600**	**32400**	**10140**	**0.195**	**0.145**
SE+	**2876.6**	**1264**	**431.2**		
CD @ 5%	**NS**	**3894.6**	**1328.7**		

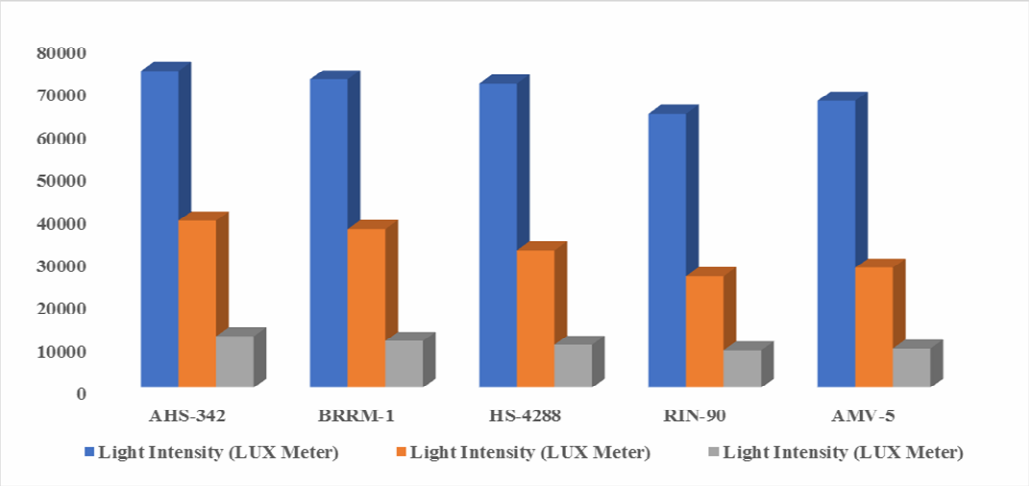

Fig. 5 : Light intensity influenced by roselle genotypes

Yield and yield contributing characters

The data on yield and yield contributing characters such as fresh weight of calyx, dry weight of calyx, total dry matter and relative dry matter efficiency are presented in Table 9 and 10. The yield-contributing characteristics showed significant associations with calyx yield per square meter at both the genotypic and phenotypic levels. Additionally, plant height, number of branches per plant, and other morphological traits significantly influenced yield and yield-related parameters.

Fresh weight of calyx

The data indicated that genotype AMV-5 (2.49 kg) showed significantly the highest fresh weight of calyx per square meter than rest of other genotypes. The Genotype HS-4288 (1.11 kg) shown significantly the lowest calyx yield per square meter.

Table 9 : Yield and yield contributing characters influenced by roselle genotypes.

Genotype	Fresh weight of calyx/ m^2 (kg)	Fresh weight of calyx/plot (kg)	Dry weight of calyx/ m^2 (g)	Dry weight of calyx/ plot (kg)
AHS-342	1.18	9.52	126.0	1.02
BRRM-1	1.63	13.23	164.3	1.33
HS-4288	1.11	9.00	113.8	0.92
RIN-90	2.00	16.20	175.2	1.41
AMV-5	2.49	20.14	319.1	2.58
Mean	**1.68**	**13.62**	**179.7**	**1.46**
SE +	**0.05**	**0.41**	**5.7**	**0.05**
CD @5%	**0.16**	**1.27**	**17.6**	**0.14**

The yield of fresh weight of calyx per plot (in kg) varies significantly among genotypes. The Genotype AMV-5 achieved significantly the highest yield at 20.14 kg, followed by RIN-90 at 16.20. The lowest yield was recorded for genotype HS-4288 at 9.00 kg.

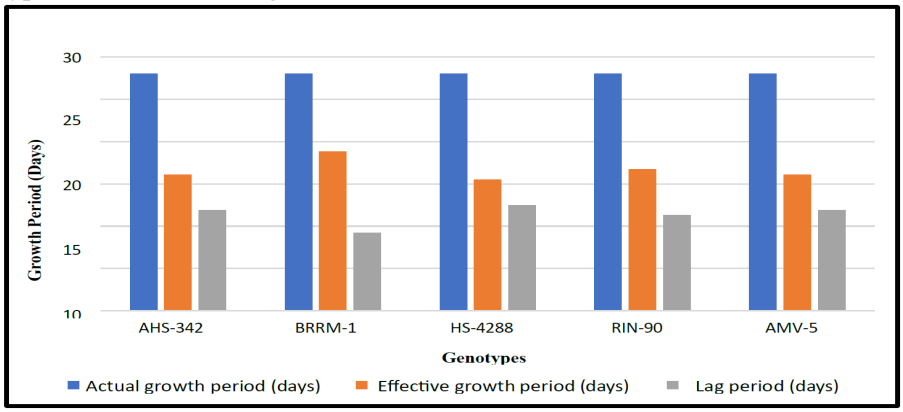

Fig. 6: Actual growth period, Effective growth period and Lag period (days) influenced by roselle genotypes for calyx growth

Dry weight of calyx

The data indicated that genotype AMV-5 had significantly the highest dry weight of calyx per square meter, measuring 319.1 grams, followed by RIN-90 at 175.2 grams. The Genotype HS-4288 recorded significantly the lowest dry weight per square meter at 113.8 grams. Additionally, the dry weight of calyx yield per plot also varied significantly. The genotype AMV-5 (2.5 kg) had significantly the highest dry weight per plot, followed by RIN-90 (1.41 kg). The lowest yield per plot was observed in genotype HS-4288 (0.92 kg). Moreover, the results for both fresh and dry calyx yield per square meter and per plot aligned with the findings of Olaniyan *et al.* (2009) and Emmanuel Abraham Sittu (2022).

Total dry matter of calyx

The data on mean total dry matter of calyx (g/m^2) at various growth stages are presented in Table 10. It was observed that, there was linear increase in calyx dry matter in all genotypes from 140 DAS and thereafter it drastically inclined up to harvest. The genotype differences as regard to the mean calyx dry matter content were statistically significant at all growth stages. The data revealed that genotype AMV-5 had significantly the highest total dry matter of calyx (12.83 g/m^2), followed by AHS-342 (10.72 g/m^2). In contrast, genotype RIN-90 exhibited significantly the lowest total dry matter of calyx at 8.76.

The overall mean relative dry matter efficiency was 16.44. Specifically, genotype AMV-5 recorded significantly the highest value 20.36, followed by AHS-342 (18.16). Again, genotype RIN-90 had significantly the lowest efficiency (12.88).

Table 10 : Total dry matter characters influenced by roselle genotypes.

Genotype	Total dry matter (g/m^2)	Relative dry matter efficiency
AHS-342	10.72	18.16
BRRM-1	10.05	14.77
HS-4288	10.23	15.98
RIN-90	8.76	12.88
AMV-5	12.83	20.36
Mean	**10.52**	**16.44**
SE+	**0.35**	**0.55**
CD @5%	**1.08**	**1.71**

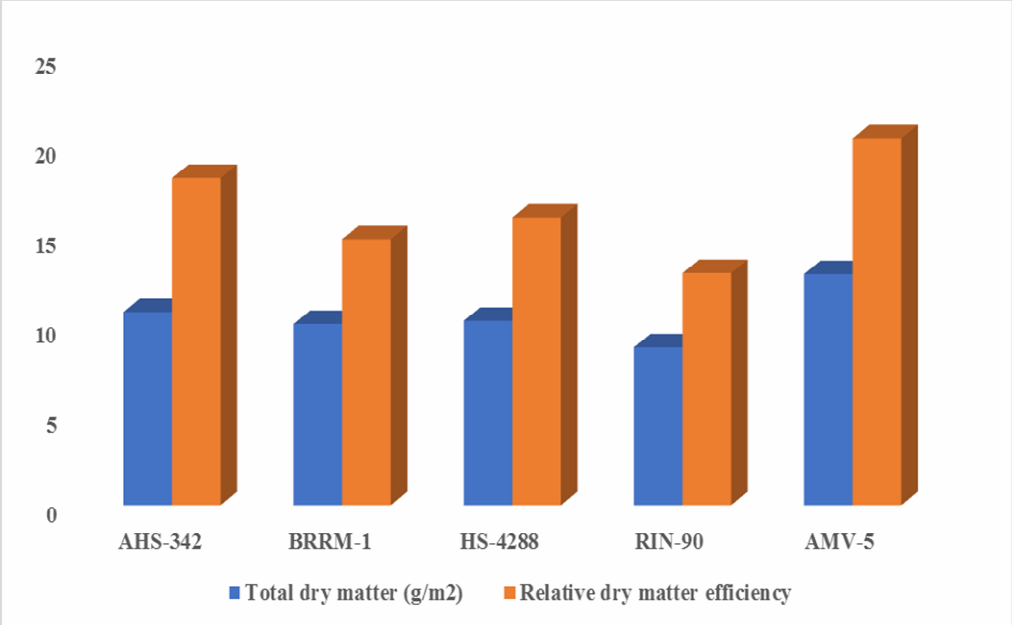

Fig. 7 : Total dry matter and relative dry matter characters influenced by roselle genotypes

Phenolic Content of Matured Calyx (mg GAE/gm)

Phenolic content in roselle (calyx) genotypes at harvest stage ranged from 36 to 42.5 mg GAE /gm and described in table 4.13. The Genotype BRRM-1 showed significantly highest phenolic content in calyx with 42.5 mg GAE/gm followed by AMV-5 with 41.5 mg GAE/gm. The Genotype AHS-342 shown significantly the lowest phenolic content 36 mg GAE/gm. Sirag *et al.* (2014) estimated that the total phenolic content of (*Hibiscus sabdariffa* L.) calyx was found to be 41.07 mg GAE/gm. Similar results were reported by Lyu *et.al* (2020) ranged from 18.75- 46.51 mg GAE/gm and Zhen *et al.* (2016) also reported the results ranged from 18.98 to 29.9 mg GAE/gm.

Table 11: Phenolic content (mg GAE/ gm) in different roselle (calyx) genotypes.

Genotype	Phenolic content (mg GAE/ gm)
AHS-342	36.0
BRRM-1	42.5
HS-4288	36.8
RIN-90	39.4
AMV-5	41.5
Mean	**39.24**
SE+	**0.971**
CD @ 5%	**2.99**

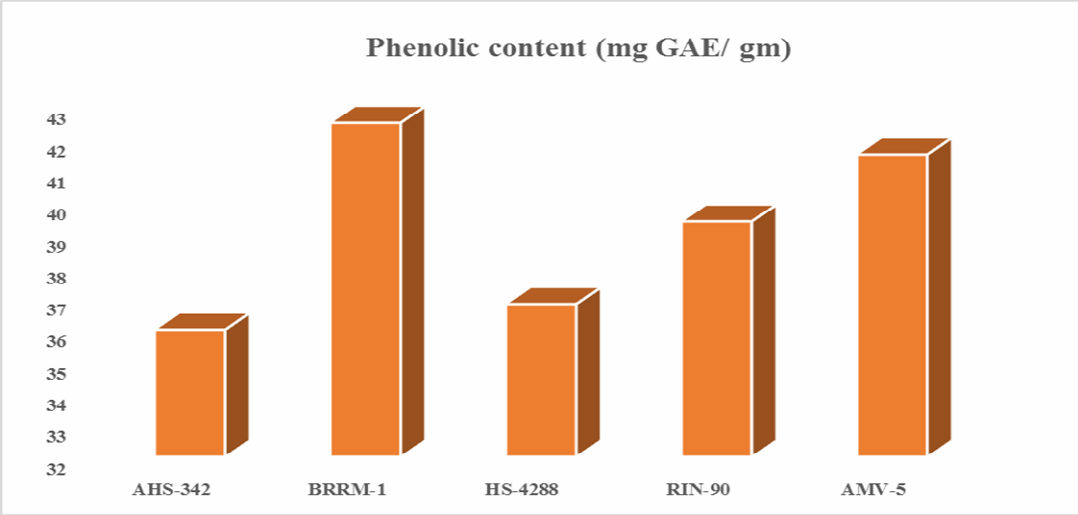

Fig. 8 : Phenolic content (mg GAE/ gm) in different roselle (calyx) genotypes.

Conclusion

The genotype AMV-5 exhibited the highest plant height, maximum number of branches per plant and consistently outperformed than other genotypes in terms of fresh weight of calyx (g), dry weight of calyx (g) and volume of calyx (ml) per flower bud. For yield, AMV-5 proved to be the most effective showed the highest fresh and dry weight of calyx per square meter and per plot. Additionally, AMV-5 demonstrated superior performance in phenolic content. On the other hand, the genotype RIN-90 excelled in the number of leaves per plant, leaf area and chlorophyll content. In terms of yield, RIN-90 also performed well, showing competitive fresh and dry weight of calyx per square meter and per plot. In conclusion, AMV-5 was superior in yield and yield-contributing traits, while RIN-90 showed better performance in yield and vegetative growth characteristics.

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