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Promising Round-shaped Variety Anand Raj Exhibiting Glossy Skin Characteristics in Brinjal (Solanum melongena L.)

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Authors' contributions

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

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ABSTRACT

In brinjal, consumer preference hinges on multifaceted criteria encompassing nutritional content, visual appeal, and culinary attributes, while farmers prioritize factors such as yield potential and market suitability. In response to this dual demand spectrum, the cultivar "Anand Raj" was meticulously developed, and tailored to excel in the unique agro-climatic conditions prevalent in

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middle Gujarat. Anand Raj, emerged from the controlled cross breeding program involving AB 07-2 x GOB 1 utilizing the pedigree method of plant breeding at the Main Vegetable Research Station of Anand Agricultural University, Anand, spanning the years 2017 to 2021. Anand Raj showcased a mean fruit yield of 425.77 q/ha, exhibiting 25.47, 20.90, 24.33, 25.69 and 32.00% higher fruit yield in whole Gujarat while evaluating under PET, SSVT and LSVT. Based on mean fruit yield data, Anand raj (513.18q/ha) exhibited 26.88, 31.65, 47.55, 35.76 and 32.00 higher fruit yield at Anand during the kharif season compared to the controls GAOB 2, GNRB 1, GRB 5, Swarna Mani Black and GOB 1, respectively. Fruits of this variety have Strong Fruit: Glossiness at harvest maturity and shows lower susceptibility to diseases and pests. This variety presents a promising option for middle Gujarat, offering improved yields and market preference.

Keywords: Anand raj; brinjal; glossiness; yield.

1. INTRODUCTION

Brinial (Solanum melongena L.), alternatively referred to as eggplant or aubergine, occupies the fifth position in significance within the Solanaceae family in subtropical and tropical regions [1]. Its cultivation and utilization trace back over 4000 years, particularly prominent in the South Asian subcontinent [2]. Research suggests that brinjal's origin may be rooted in India, with indications pointing to the Indo-Burma region as its likely center of origin [3]. On the other hand, there is conjecture regarding its secondary origin in China, contributing to its taxonomic complexity within the Solanaceae family-which is economically significant and has fundamental chromosomal number а of 2n=2x=24 [1]. As a vegetable crop, brinjal is very important, especially in Southeast Asia and Africa, where it is a staple diet [4].

With its exceptional resilience to a wide range of environmental circumstances, brinjal thrives in equatorial, tropical, and humid climates found in Asia, Africa, and the southern United States. Due to difficult temperature regimes, brinjal growth was historically restricted to areas lacking temperate hills. But recent changes in the climate have made these temperate zones suitable for growing brinjal. The best crop lifetime is ensured by the April-September cultivation window, which makes it easier to produce fruits of superior quality that are less susceptible to pest infestation, especially from borers. Despite being predominantly self-pollinated, brinial demonstrates a significant potential for crosspollination, attributed to pronounced heterostyly mechanisms favoring such interactions. Fruit set percentage vary across floral types, ranging from 70 to 86.70% in long-styled flowers and 12.5 to 55.60% in medium-styled flowers, reflecting genetic and environmental influences. Brindavan is important for agriculture, but it's also used medicinally in traditional systems like as

Ayurveda and Unani, where different portions of the plant are used for their therapeutic qualities. Its fruits and roots are said to have antiinflammatory and pain-relieving qualities, while its leaves and seeds are linked to hunger stimulation, asthma relief, and cardio-tonic benefits. Interestingly, white brinjal cultivars are said to treat diabetics, demonstrating the variety of pharmacological potential that brinjal cultivars possess.

Presently, brinjal cultivation is widespread across several nations including China, Pakistan, India, Bangladesh, Sri Lanka, Nepal, Egypt, the United Arab Emirates, and other equatorial regions. According to FAOSTAT [5] data, global brinjal production stands at an estimated 54.08 million with Asian countries contributing tons. approximately 93% of this total output. In India. the cultivation area for brinjal in 2023 was recorded at 0.788 million hectares, yielding an estimated annual production of 12.76 million tonnes, achieving a productivity rate of 16.19 tonnes per hectare [6]. Key brinjal-producing states in India include West Bengal, Odisha, Gujarat, Madhya Pradesh, and Bihar. Notably, within Gujarat, brinjal ranks third in cultivation area and production, following potato and tomato. In the agricultural year 2022-23, brinjal was cultivated across 81,673 hectares in Gujarat, resulting in an annual production of 16.24 lakh tonnes and a productivity rate of 19.89 tonnes per hectare [7].

Brinjal exhibits extensive genetic diversity across various geographical regions, encompassing a wide array of traits such as fruit size, shape, color, growth habit, canopy bearing, yield potential, and resistance to diseases and insect pests [8]. Moreover, this genetic variation extends to other critical attributes including vegetative growth, maturity, and the presence or absence of spines on leaves, stems, and fruit calyxes within indigenous brinjal populations (Pujer et al., 2018). Current research has revealed that different brinjal cultivars have diverse biochemical compositions. Long-fruited cultivars have larger concentrations of free reducing sugars, anthocyanins, phenols, and glycoalkaloids, whereas oblong-fruited types have higher amounts of total soluble sugars (e.g., solasodine), dry matter, and amide proteins [9].

Consumer preference hinges on multifaceted criteria encompassing nutritional content, visual appeal, and culinary attributes, while farmers prioritize factors such as yield potential and market suitability. In response to this dual demand spectrum, the cultivar "Anand Raj" was meticulously developed, tailored to excel in the unique agro-climatic conditions prevalent in middle Gujarat. This variety boasts a distinctive trait of high glossiness on its fruit epidermis, a characteristic sought after by discerning consumers for its aesthetic appeal and indicative of fruit quality. Simultaneously, "Anand Raj" is engineered to exhibit prolific yield potential, aligning with the production objectives of farmers and addressing market demands effectively.

2. MATERIALS AND METHODS

2.1 Experimental Materials and Design

The genotype AB 17-28, alternatively known as Anand Rai, emerged from the controlled cross breeding program involving AB 07-2 x GOB 1 utilizing the pedigree method of plant breeding at the Main Vegetable Research Station of Anand Agricultural University, Anand, spanning the years 2017 to 2021. The field experiment was executed following a randomized complete block design, comprising three replications, while GAOB 2, GNRB 1, GRB 5, Swarna Mani Black and GOB 1 were deployed as check varieties. Each experimental plot encompassed 30 to 40 plants, adhering to a spacing pattern of 90 x 60 cm across various years and locations. Transplanting involved the sowing of 2 seeding per hole, with subsequent thinning to a singular plant per hole once plants attained the 5-10 leaf stages.

2.2 Phenotyping and Statistical Analysis

Data were systematically collected encompassing a range of phenology traits, including the plant height (cm), branches per plant, fruits per plant, fruit length (cm), fruit girth (cm), fruit weight (g), days to first picking after transplanting, leaf: length (cm), leaf: width (cm), fruit: length of peduncle (cm), seeds per fruit. 1000 seed weight (g), fruit firmness (N), fruit volume (cc) and fruit yield q/ha. Additionally, biochemical attributes including moisture (%), total soluble solids (°Brix), total soluble sugars (%). reducing sugars (%), acidity (%), acidity/sugar, flavanoid (mg/100gm), phenol (%), anthocyanin (mg/100gm), ascorbic acid (mg/100gm), glycoalkaloid (mg/100gm) were meticulously recorded following standardized protocols at the Biochemistry Department, A.A.U., Anand. Subsequent statistical analyses were conducted utilizing the INDOSTAT software (IndoStat Inc., Hyderabad, India) within the Statistical Department at A.A.U., Anand.

2.3 Genotypic Diversity Analysis

CTAB protocol of Doyle and Doyle [10] was used to extract the genomic DNA. PCR reaction was performed using SSR marker and result observe using 3% agarose gel electrophoresis at department of Plant Biotechnology, A.A.U., Anand.

3. RESULTS AND DISCUSSION

3.1 Yield Performance

Brinjal variety Anand Raj was derived from the segregating population resulting from the cross AB 07-2 x GOB 1. The morphological attributes of Anand Raj along with checks for the kharif seasons are delineated in Table 1. Anand Raj exhibited higher Plant height (92.3 cm), Fruit girth (22.7 cm), Fruit weight (143.4 g), Leaf: Length (22.3 cm), Leaf: Width (13.8 cm), Fruit volume (196 cc) and Fruit yield (425.77 g/ha). Anand Raj showcased a mean fruit yield of 425.77 g/ha, exhibiting 25.47, 20.90, 24.33, 25.69 and 32.00% higher fruit yield in whole Gujarat compared to the controls GAOB 2, GNRB 1, GRB 5, Swarna Mani Black and GOB 1, respectively (Table 2) while evaluating under PET, SSVT and LSVT. Based on mean fruit yield data, Anand raj (513.18q/ha) exhibited 26.88, 31.65, 47.55, 35.76 and 32.00% higher fruit yield at Anand during the kharif season compared to the controls GAOB 2, GNRB 1, GRB 5, Swarna Mani Black and GOB 1, respectively (Table 3). Moreover, across four trials at Anand, Anand Rai consistently ranked within the top non-significant group. Anand Raj emerges as a high-yielding, large fruit size with glossy appearance rendering it favourable for farmers. Results were in accordance with findings of Rathod et al. [11].

Sr.	Characters	Anand Raj	GAOB 2 (C)	GNRB 1 (C)	GRB 5 (C)	S. Mani Black (NC)	GOB 1 (C)
No.							
1	Plant height (cm)	92.3 (85.0-101.0)	88.8 (79.4-102.0)	78.8 (75.6-90.0)	86.9 (76.2-98.5)	69.8 (62.8-78.9)	68.3 (60.7-76.6)
2	Branches per plant	3.0 (2.7-4.0)	3.3 (2.7-4.2)	2.7 (2.0-3.6)	2.7 (2.3-3.6)	3.0 (2.7-3.7)	2.7 (2.3-3.3)
3	Fruits per plant	22.5 (19.8-25.3)	24.5 (21.6-26.7)	28.6 (26.0-30.8)	23.5 (21.2-25.2)	24.2 (22.4-26.6)	20.0 (18.0-21.8)
4	Fruit length (cm)	11.5 (10.6-12.8)	12.2 (11.5-13.8)	11.7 (10.5-13.0)	10.9 (9.6-12.3)	10.5 (9.3-12.7)	12.0 (11.0-13.2)
5	Fruit girth (cm)	22.7 (18.0-24.6)	18.3 (13.2-19.8)	17.1 (12.5-19.0)	17.3 (11.5-19.5)	21.8 (17.4-23.9)	19.0 (14.0-22.2)
6	Fruit weight (g)	143.4 (118.6-165.0)	95.9 (81.3-115.6)	79.6 (66.4-91.7)	85.6 (72.4-97.3)	89.3 (77.8-104.2)	118.6 (106.6-132.0)
7	Days to first picking	56 (52-60)	60 (55-63)	63 (58-66)	65 (60-70)	60 (57-66)	62 (58-66)
	after transplanting						. ,
8	Leaf: Length (cm)	22.3 (19.1-24.4)	20.0 (17.8-23.2)	18.7 (16.6-21.0)	19.2 (18.1-23.5)	18.3 (16.5-21.0)	20.3 (18.5-23.2)
9	Leaf: Width (cm)	13.8 (12.5-15.3)	10.5 (9.2-12.8)	11.2 (10-14)	12.4 (10.9-14.3)	11.4 (9.8-13.7)	11.8 (10.2-13.5)
10	Fruit: Length of	4.8 (3.9-5.6)	4.6 (3.8-5.5)	5.3 (4.5-6.4)	4.8 (4.2-6.0)	5.2 (4.5-6.3)	5.0 (3.8-6.0)
	peduncle (cm)	, , , , , , , , , , , , , , , , , , ,	, , , , , , , , , , , , , , , , , , ,	(, ,	, ,		, , , , , , , , , , , , , , , , , , ,
11	Seeds per fruit	1710 (1529-1914)	1725 (1529-1882)	2062 (1987-2168)	1656 (1436-1776)	2707 (2512-3062)	1886 (1781-2082)
12	1000 seed weight (g)	5.690 (5.478-5.916)	4.787 (4.572-5.007)	6.254 (6.049-6.479)	5.409 (5.199-5.634)	4.990 (4.770-5.215)	4.311 (4.101-4.536)
13	Fruit firmness (N)	13.96 (12.57-15.26)	12.91 (12.19-14.16)	10.83 (9.80-11.59)	16.26 (15.39-17.08)	12.83 (11.74-14.50)	10.17 (8.30-12.43)
14	Fruit volume (cc)	196 (162-226)	92 (78-111)	61 (51-70)	62 (53-71)	88 (76-102)	152 (136-169)

Table 1. Ancillary observations of economic attribute of brinjal variety Anand Raj along with checks

Year/	Name of	Locations	Fruit yield (q/h	a)					S. Em	CD at 5	CV %
Season	trial	al	Anand Raj	Checks GAOB 2 (a)	GNRB 1 (b)	GRB 5 (c)	S. Mani Black (d)	GOB 1 (e)	±	%	
2017-18	PET	Anand	532.41 ^{ae}	390.05	-	-	-	389.66	21.68	61.38	13.55
/Kharif-		Mean (1)	532.41	390.05	-	-	-	389.66			
Rabi		% Inc. over th	e checks	36.50	-	-	-	36.64			
2018-19	SSVT	Anand	514.66 ^{ae}	424.00	-	-	-	363.04	17.49	50.08	10.79
/Kharif-		Mean (1)	514.66	424.00	-	-	-	363.04	-		
Rabi		% Inc. over th	e checks	21.38	-	-	-	41.76			
2019-20	LSVT	Anand	496.40 ^{abcde}	405.61	390.95	331.79	383.23	408.95	29.78	86.57	12.45
/Kharif- Rabi		Junagadh	506.66 ^{abcd}	395.76	385.21	402.01	371.30	-	24.76	72.28	9.76
		Navsari	262.10	263.51	319.81	309.94	274.88	-	19.31	56.36	11.23
		Waghai	351.65 ^d	294.19	300.36	313.66	261.60	-	27.60	80.40	13.23
		Ladol	275.28ª	198.09	229.92	229.57	261.54	-	20.67	60.07	13.76
		Mean (1)	496.40	-	-	-	-	408.95			
		Mean (5)	378.42	311.43	325.25	317.39	310.51				
		% Inc. over th	e checks	21.51	16.35	19.23	21.87	21.38			
2020-21	LSVT	Anand	509.26 ^{abcde}	398.15	372.94	349.79	357.51	393.52	24.26	70.80	10.49
/Kharif- Rabi		Junagadh	445.78 ^{abcd}	357.18	346.63	363.43	332.72	-	23.21	68.27	9.90
		Navsari	388.09 ^a	296.42	356.97	350.55	392.36	-	23.78	69.76	11.74
		Waghai	401.16 ^{abcd}	309.70	305.04	274.05	258.05	-	16.68	48.91	9.33
		Ladol#	50.35	50.97	55.59	54.84	65.06	-	7.39	NS	20.65
		Mean (1)	509.26	-	-	-	-	393.52			
		Mean (4)	436.07	340.36	345.40	334.46	335.16				
		% Inc. over th	e checks	28.12	26.25	30.38	30.11	29.41			
Over all mean (4) 513.18						388.79					
Over all mean	n (9)		404.04		334.20	324.98	321.47				
Over all mean	n (11)		425.77	339.34							
Overall % inc	rease over	checks		25.47	20.90	24.33	25.69	32.00			
Frequency in	top non-sig	gni. Groups	9/11	1/11	3/9	3/9	1/9	0/4			

Table 2. Yield performance of brinjal variety Anand Raj in comparison with check varieties in the Gujarat state

Note: - a, b, c, d, e indicates the significantly superior than respective check # Data was not considered due below state average

Year / Season	Name of	Location	Fruit yield (q/ł	na)					S. Em	CD at 5	CV %
	trial		Anand Raj	Checks GAOB 2 (a)	GNRB 1 (b)	GRB 5 (c)	S. Mani Black (d)	GOB 1 (e)	±	%	
2017-18/	PET	Anand	532.41 ^{ae}	390.05	-	-	-	389.66	21.68	61.38	13.55
Kharif-Rabi		% Inc. over the checks		36.50	-	-	-	36.64			
2018-19/	SSVT	Anand	514.66 ^{ae}	424.00	-	-	-	363.04	17.49	50.08	10.79
Kharif-Rabi		% Inc. over t	he checks	21.38	-	-	-	41.76			
2019-20/	LSVT	Anand	496.40 ^{abcde}	405.61	390.95	331.79	383.23	408.95	29.78	86.57	12.45
Kharif- Rabi		% Inc. over t	he checks	22.38	26.97	49.61	29.53	21.38			
2020-21/	LSVT	Anand	509.26 ^{abcde}	398.15	372.94	349.79	357.51	393.52	24.26	70.80	10.49
Kharif- Rabi		% Inc. over t	he checks	27.91	36.55	45.59	42.45	29.41			
Over all mean (2)		502.83	-	381.95	340.79	370.37				
Over all mean (4)		513.18	404.45				388.79			
Over all % increase over checks			26.88	31.65	47.55	35.76	32.00				
Frequency in top non-signi. Groups			4/4	0/4	0/2	0/2	0/2	0/4			

Table 3. Yield performance of brinjal variety Anand Raj in comparison with checks in the middle Gujarat

Note: - a, b, c, d, e indicates the significantly superior than respective check

Sr.	Characters	Anand Raj	GAOB 2	GNRB 1	GRB 5	S. Mani	GOB 1
No.			(C)	(C)	(C)	Black (NC)	(C)
1	Seedling: Anthocyanin colouration of	Absent	Absent	Absent	Absent	Absent	Absent
	hypocotyl			_		_	
2	Stem: Anthocyanin colouration	Absent	Absent	Present	Absent	Present	Absent
3	Stem: Intensity of Anthocyanin colouration	-	-	Medium	-	Strong	-
4	Stem: Pubescence	Medium	Medium	Medium	Medium	Medium	Medium
5	Leaf: Length	Medium	Medium	Medium	Medium	Medium	Medium
6	Leaf: Width	Medium	Medium	Medium	Medium	Medium	Medium
7	Leaf: Margin	Dentate	Sinuate	Entire	Sinuate	Entire	Sinuate
8	Leaf: Blistering	Absent	Absent	Absent	Absent	Absent	Absent
9	Leaf: Spininess	Absent	Absent	Absent	Absent	Absent	Absent
10	Leaf: Blade colour	Green	Green	Green	Green	Green	Green
11	Leaf: Intensity of colour of blade	Medium	Medium	Medium	Medium	Medium	Medium
12	Leaf: Colour of vein	Green	Purple	Purple	Light	Purple	Purple
			·		purple	·	·
13	Leaf: Intensity of colour of veins	Medium	Medium	Dark	Medium	Dark	Medium
14	Flower: Size	Medium	Medium	Medium	Medium	Medium	Medium
15	Flower: Colour	Purple	Light purple	Light purple	Light purple	Purple	Purple
16	Flowering time (after transplanting)	Early	Medium	Medium	Medium	Early	Medium
17	Fruit: Length	Medium	Medium	Medium	Medium	Medium	Medium
18	Fruit: Diameter	Medium	Medium	Medium	Medium	Medium	Medium
19	Fruit: Length/ diameter ratio	Medium	Medium	Medium	Medium	Medium	Medium
20	Fruit: General shape	Ovoid	Obovate	Ovoid	Ovoid	Globular	Obovate
21	Fruit: Diameter of pistil scar	Small	Large	Small	Medium	Small	Medium
22	Fruit: Shape of apex	Rounded	Rounded	Rounded	Rounded	Indented	Rounded
23	Fruit: Colour of skin at commercial	Purple	Purple	Purple	Green	Purple	Purple
	harvesting						
24	Fruit: Intensity of purple colour of	Dark	Light	Medium	-	Dark	Dark
	skin						
25	Fruit: Stripes	Absent	Absent	Absent	Absent	Absent	Absent
26	Fruit: Patches	Absent	Absent	Absent	Present	Absent	Absent
27	Fruit: Glossiness at harvest maturity	Strong	Medium	Medium	Medium	Medium	Medium
28	Fruit: Size of calyx	Medium	Medium	Medium	Medium	Medium	Medium
29	Fruit: Colour of calyx	Green	Green	Purple	Green	Purple	Green
30	Fruit: Intensity of colour of calyx	Strong	Medium	Medium	Strong	Medium	Medium

Table 4. Morphological characters of proposed brinjal variety Anand Raj along with checks (As per DUS Guidelines)

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Sr. No.	Characters	Anand Raj	GAOB 2 (C)	GNRB 1 (C)	GRB 5 (C)	S. Mani Black (NC)	GOB 1 (C)
31	Fruit: Spininess of calyx	Absent	Médium	Médium	Absent	Weak	Absent
32	Fruit: Ribs	Absent	Absent	Absent	Absent	Absent	Absent
33	Fruit: Creasing of calyx	Weak	Strong	Weak	Medium	Weak	Weak
34	Fruit: Colour of flesh	Whitish	Whitish	Whitish	Whitish	Whitish	Whitish
35	Fruit: Length of peduncle	Medium	Medium	Medium	Medium	Medium	Medium
36	Fruiting: Pattern	Solitary	Solitary	Solitary	Solitary	Solitary	Solitary
37	Plant: Growth habit	Semi spreading	Erect	Semi spreading	Erect	Spreading	Spreading
38	Plant: Height	Medium	Medium	Medium	Medium	Short	Medium
39	Plant: Spread (distance between two	Medium	Medium	Medium	Medium	Broad	Medium
	extremes leaf tips at widest point						
40	Fruit: Colour of skin at physiological	Brown	Brown	Brown	Brown	Brown	Brown
	maturity						

Table 5. Biochemical parameters of proposed brinjal variety Anand Raj along with checks

Sr.	Characters	Anand Raj	GAOB 2	GNRB 1	GRB 5	S.Mani	GOB 1
No.			(C)	(C)	(C)	Black	(C)
						(NC)	
1	Moisture (%)	89.91	86.45	88.86	88.46	89.61	88.77
2	Total soluble solids (°Brix)	5.50	6.50	6.30	5.40	6.40	5.30
3	Total soluble sugars (%)	3.92	3.78	3.04	3.17	3.76	3.25
4	Reducing sugars (%)	2.51	2.46	2.49	1.73	2.41	1.80
5	Acidity (%)	0.07	0.08	0.07	0.08	0.06	0.11
6	Acidity/sugar	0.02	0.02	0.02	0.03	0.02	0.03
7	Flavanoid (mg/100gm)	116	131	122	114	124	127
8	Phenol (%)	0.13	0.16	0.13	0.12	0.13	0.14
9	Anthocyanin (mg/100gm)	73.59	31.07	31.12	2.92	41.23	85.95
10	Ascorbic acid (mg/100gm)	10.02	9.19	9.88	10.30	11.55	10.16
11	Glycoalkaloid (mg/100gm)	8.50	9.36	8.82	7.38	6.04	5.11

		(a) Little le	eaf diseas	e (%) at Ai	nand						
Diseases	Year and	Name of		Varieties							
	season	trial	Anand Raj	GAOB 2 (C)	GNRB 1 (C)	GRB 5 (C)	S.Mani Black (NC)	GOB 1 (C)			
Little leaf disease (%)	2017-18 Kharif- Rabi	PET	2.03	3.30	-	-	-	5.04			
	2018-19 Kharif- Rabi	SSVT	0.00	5.70	-	-	-	2.10			
	2019-20 Kharif- Rabi	LSVT	4.17	6.94	6.94	4.17	8.33	11.11			
	2020-21 Kharif- Rabi	LSVT	0.00	2.00	1.33	23.00	15.20	3.33			
	Range		0.00- 4.17	2.00- 6.94	1.33- 6.94	4.17- 23.00	8.33- 15.20	2.10- 11.11			
	Reaction		R	R	R	MS	MS	R			

Table 6. Rating of incidence of diseases at Anand

Table 7. Rating scale of disease reaction and its description

Rating Scale	Disease reaction	Severity Range (%)	
0	Highly resistant (HR)	0% infection (all plants free of symptoms)	
1	Resistant (R)	up to 15% plants infected	
2	Moderately susceptible (MS)	15 to 25% plants infected	
3	Susceptible (S)	25 to 50% plants infected	
4	Highly susceptible (HS)	more than 50 % plants infected	

Table 8. Rating of incidence of insect-pests at Anand centre

Insect-	Year and	Name	e Varieties						
pests	Season	of trial	Anand Raj	GAOB 2 (C)	GNRB 1 (C)	GRB 5 (C)	S.Mani Black (NC)	GOB 1 (C)	
Number of jassid	2019-20 Kharif-Rabi	LSVT	3.33	4.16	4.24	4.64	4.20	5.49	
per leaf	2020-21 Kharif-Rabi	LSVT	0.73	2.70	1.57	5.50	5.70	3.50	
Range			0.73-3.33	2.70-4.16	1.57-4.24	4.64-5.50	4.20-5.70	3.50-5.49	
Number of	2019-20 Kharif-Rabi	LSVT	3.20	3.78	5.33	5.09	4.33	4.71	
Whitefly per leaf	2020-21 Kharif-Rabi	LSVT	2.29	3.66	3.42	4.75	6.68	2.89	
Range			2.29-3.20	3.66-3.78	3.42-5.33	4.75-5.09	4.33-6.68	2.89-4.71	
Shoot and fruit	2019-20 Kharif-Rabi	LSVT	4.21	8.23	4.44	4.33	4.94	4.11	
borer damage (%)	2020-21 Kharif-Rabi	LSVT	1.80	6.47	2.37	8.73	6.52	3.56	
Range			1.80-4.21	6.47-8.23	2.37-4.44	4.33-8.73	4.94-6.52	3.56-4.11	

3.2 Morphological Characters

Fruits of this variety are Ovoid in Fruit: General shape with Strong Fruit: Glossiness at harvest maturity and Semi spreading Plant: Growth habit

(Table 4, Figs. 1 and 2). The morphological diversity of the developed variety Anand Raj is described in the Table 4 as per the DUS guideline. The NBPGR has assigned the National Identity number as IC 638928 [12].

Primer Nam	ne (P1): smSSR0	1							
	1	2	3	4	5	6			
Band	GOB-1 (LC)	GNRB-1	S Mini Black	Anand Raj	GRB-5 (C)	GAOB-2			
number		(LC)	(NC)			(LC)			
1	328	328	328	328	328	-			
2	-	-	-	-	-	340			
Primer Name (P2): smSSR03									
	1	2	3	4	5	6			
Band	GOB-1 (LC)	GNRB-1	S Mini Black	Anand Raj	GRB-5 (C)	GAOB-2 (LC)			
number		(LC)	(NC)						
1	-	-	-	152	-	-			
2	160	160	160	-	160	160			
Primer Nam	ne (P3): smSSR0	4							
	1	2	3	4	5	6			
Band	GOB-1 (LC)	GNRB-1	S Mini Black	Anand Raj	GRB-5 (C)	GAOB-2 (LC)			
number		(LC)	(NC)	-		. ,			
1	-	-	-	331	-	-			

Table 9. Genetic diversity in band size of the brinjal variety Anand Raj along with checks



Fig. 1. Appearance of the fruits of brinjal variety Anand Raj



Fig. 2. Plant with fruits of brinjal variety Anand Raj



Fig. 3. DNA fingerprinting report of brinjal variety Anand Raj generated by SSR marker system

3.3 Nutritional Quality

The variety contains higher Moisture (89.91%), Total soluble sugars (3.92%) and Reducing sugars (2.51%) as compared to the checks GAOB 2, GNRB 1, GRB 5, Swarna Mani Black and GOB 1 (Table 5). High total soluble sugars and reducing sugars in brinjal are crucial for several reasons. Firstly, they contribute to the overall sweetness and palatability of the fruit, enhancing its taste and consumer acceptance. Moreover, these sugars play a significant role in determining the fruit quality and nutritional value, making it more desirable for consumption. Scientifically, studies have shown that elevated levels of total soluble sugars and reducing sugars in brinjal are associated with increased fruit sweetness, nutritional content, and overall quality [9]. Therefore, focusing on enhancing these sugar levels in brinial cultivars can lead to improved consumer acceptance and market value.

3.4 Biotic Stress Tolerance

Anand raj exhibits reduced incidence rates of little leaf disease (%) in contrast to the control varieties GAOB 2, GNRB 1, GRB 5, Swarna Mani Black and GOB 1 at Anand (Table 6). Moreover, this genotype manifests diminished Shoot and fruit borer damage (%) and minimal infestation levels of jassid and whitefly when juxtaposed with the GAOB 2, GNRB 1, GRB 5, Swarna Mani Black and GOB 1 at Anand Location (Table 8).

3.5 Molecular Characterisation

The DNA fingerprinting analysis utilizing the SSR marker smSSR01, smSSR03, smSSR04

delineated distinct genetic profiles among the brinjal varieties, particularly highlighting the genetic uniqueness of variety Anand Raj in comparison to its reference varieties, namely GAOB 2, GNRB 1, GRB 5, Swarna Mani Black and GOB 1. Marker smSSR03 and smSSR04 produce unique band of 152 bp and 331 bp. (Table 9 and Fig. 3). 100 plus ladder was used as reference to measure band size.

4. CONCLUSION

The new variety excels in middle Gujarat, yielding 513.18 q/ha, surpassing 26.88, 31.65, 47.55, 35.76 and 32.00% higher fruit yield at Anand during the *kharif* season compared to the controls GAOB 2, GNRB 1, GRB 5, Swarna Mani Black and GOB 1, respectively. Fruits of this variety are Ovoid in Fruit: General shape with Strong Fruit: Glossiness at harvest maturity and Semi spreading Plant: Growth habit. It contains higher Moisture (89.91%), Total soluble sugars (3.92%) and Reducing sugars (2.51%) and shows lower susceptibility to diseases and pests. This variety presents a promising option for middle Gujarat, offering improved yields and market preference.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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