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Research Article

Organoleptic profiling for demand led breeding of eggplant (*Solanum melongena* L.) suitable for Kerala market

Kasireddy Sivasankarreddy[1], Jiji Joseph[1]* and P. P. Thirumalaisamy[2]

[1]Department of Plant Breeding and Genetics, Kerala Agricultural University, Thrissur, Kerala, India -680656
[2]ICAR-National Bureau of Plant Genetic Resources, Regional Station, Thrissur, Kerala, India - 680656
***E-Mai**l: jiji.joseph@kau.in

Abstract
In order to develop eggplant hybrids with consumer acceptance, an organoleptic evaluation of fruits in two different sets of eggplant genotypes was conducted by a panel of 15 judges with 21 descriptors, following a quantitative descriptive analysis (QDA). In 2023, twenty genotypes were evaluated as the first set to identify suitable parents for hybridization. The results showed significant variation in odour, appearance, texture, flavor and taste, and overall quality attributes. From the first set, five genotypes (Ponni, Vengeri, IC618016, IC636521, and IC624240) were selected to produce ten F_1 hybrids, and they were further evaluated, along with parents and three popular varieties as check in 2024. In the second set, many descriptors showed no significant variation. F_1 hybrid, Vengeri x IC636521, showed higher yield and overall quality attributes, and most of the other hybrids (seven) were high yielders over popular checks with on par for overall quality. The findings suggest the role of organoleptic evaluation in selection and development of quality breeding materials.

Keywords: Odour, Appearance, Texture, Flavour, Taste, Overall quality

INTRODUCTION

The genus *Solanum* comprises more than 1200 species, which have nutraceutical and medicinal properties. This genus consists of eggplant (*Solanum melongena* L.), which is widely used as a vegetable. The fruit of eggplant has very low caloric value, and fruits are good sources of dietary fiber, calcium, potassium, magnesium, copper, vitamin A, vitamin B1, vitamin B2 and vitamin C (Praneetha, 2017; Edeke *et al.,* 2021; Balkrishna *et al.,* 2022). The potassium helps to maintain hydration and regulate the blood pressure. In addition to minerals and vitamins, it also contains various phytonutrients and phenolic compounds like chlorogenic acid (Gramazio *et al.,* 2014), which has anti-cancerous, anti-viral, and anti-microbial properties. It also have flavonoid compounds like nasunin that had the properties of iron chelation (removes excess iron), thus helping in lowering the risk of cancer, heart diseases, and rheumatic arthritis (Fraikue, 2016). Due to these nutritional and health benefits it is preferred by most of the households of all income levels and social statuses. It is often known as the poor man's crop and "King of vegetables" in India due to its versatile nature and wide usage in day-to-day meals and festivals in south Indian food (http://www.celkau.in/crops/vegetables/brinjal/brinjal.aspx). The fruits are often eaten after roasting and have a distinctly spicy flavor. However, consumer preference varies from place to place in Indian states, and it plays a significant role in diversifying this vegetable crop (Senthilvadivu *et al.,* 2023).

Kerala's major eggplant fruit types are oval or elongated, with glossy purple and green types (Surya, Haritha and Neelima). Eggplant shared 3.46% of Keralas vegetable production during 2021-22 (Agricultural statistics, 2021-22) and whose market price was higher compared to other south Indian states. Even though eggplant is a versatile and popular food crop in Kerala and other parts of India, it has yet to be fully utilized in the formal market space in Kerala. There is an opportunity to develop new eggplant cultivars with more acceptability.

In plant breeding programmes the primary concern of breeders is to develop varieties with yield and resistance to stresses. Nagappan and Vethamoni (2016) also suggested the utilization of the resistant sources in breeding programmes. The increased consumer awareness about nutritional quality and taste demands to focus on quality aspects. So, early screening of resistance sources with consumer acceptability through various tests can be the most accurate measure for easy acceptance and more market reach of varieties. A few preliminary studies were conducted for organoleptic evaluation of eggplant in Europe (Gajewski and Arasimowicz, 2004), Africa (Eze *et al.,* 2012), and India (Puthiamadom, 2021). These studies suggested the organoleptic descriptors for eggplant evaluation, including odor, appearance, texture, flavor, taste, and overall quality. These organoleptic attributes need to be recorded on a standard hedonic scale to implement a quantitative descriptive analysis (QDA) approach. This QDA is used to determine organoleptic profile of any food and its products. There were several reports that implemented QDA method extensively for food crops and their products like Eggplant (Gajewski and Arasimowicz, 2004; Eze *et al.,* 2012), Local rice (Rakhmi, 2013), Sweet potato (Dery *et al.,* 2021; Nakitto *et al.,* 2022), Low-fat chocolate drink (Muktiningrum *et al*., 2022) and Steamed brownies (Fauza *et al*., 2021).

Analysis of variance (ANOVA) is used to analyze the data which helps to assess attributes to identify genotypes preferred by consumers. Only a few reports are available on the organoleptic properties of eggplant fruits from Kerala and India. Therefore, the current study tried to compare the organoleptic properties of bacterial wilt resistant genotypes and utilize better genotypes to develop market ready hybrids.

MATERIALS AND METHODS

Experimental material: The experiment was conducted with two different sets of eggplant genotypes in 2023 and 2024, respectively. The experimental materials for first set was selected based on bacterial wilt resistance screening of above hundred accessions of eggplant in our previous experiment with popular bacterial wilt resistant variety Haritha. First set comprised twenty bacterial wilt resistant eggplant genotypes with Haritha as provided in **Table 1**. They were evaluated in 2023 and from this top, five genotypes (Ponni, Vengeri, IC618016, IC636521 and IC624240) were selected for hybridization programme. The genotypes were crossed in half diallele fashion to produce a total of ten single cross hybrids. These F_1 hybrids, parents, and three popular cultivars as checks [Haritha, Surya and Neelima (F_1 hybrid)] were evaluated for as second set (**Table 2**) in 2024.

Methodology followed for organoleptic evaluation: The fruits were harvested at the commercial ripeness stage for organoleptic evaluation by constituting a panel of 15 people between the age group 22-55. The fruits were sliced into approximately 1-1.5 cm thick and roasted in oil for 5 minutes before cooling to room temperature. The uncooked and fried samples were placed on paper plates and distributed randomly to assessors with two replications. The panel performed organoleptic evaluation (Total 21 descriptors) of eggplant fruits by using the quantitative descriptive analysis (QDA) for odour (7 descriptors), appearance (2 descriptors), texture (4 descriptors), flavour and taste (6 descriptors), and overall quality (1 descriptor) as developed by Gajewski and Arasimowicz (2004) along with market preference of fruits as additional descriptor to overall quality. The panel evaluated uncooked samples for odour, appearance descriptors; cooked samples for texture, flavour and taste, overall quality of fruits; fresh fruits for market preference of fruits and scored every descriptor of each genotype on a two-point hedonic scale (Puthiamadom, 2021), ranging from 0 [odour-none; appearance-light brown, low seed; texture-soft, non-juicy, smooth; flavour and taste-none] to 2 [odour-very intensive; appearance-dark brown, more seed; texture-firm, juicy, fibrous, hard; flavour and taste-very intensive]. For overall quality of fruits and market preference of fruits, the same scale, from 2 (high quality) to 0 (low quality) was used to determine the level of overall consumer preference. The hedonics scale ratings were converted to mean scores and statistical analysis was carried out.

Statistical analysis: The data were analysed by one-way analysis of variance (ANOVA) model (genotypes as fixed variables and panelists as a random factor) using mean comparison conducted using the Tukey's test at 5per cent significance for each organoleptic attribute. The mean values obtained for each genotype across all organoleptic attributes were graded and tabulated. The yield per plant was recorded separately in each experiment and subjected to ANOVA and Duncan multiple range test (DMRT) at 5per cent significance. The statistical analysis was performed by using the grapesAgri1 web application (Gopinath *et al.,* 2021).

Construction of selection index in first set: The mean values of yield per plant, overall quality of fruits and market preference of fruits were used as component characters with equal weight given to each character. These component characters were merged into a score, or index according to Arunachalam and Bandyopadhyay (1984), in such a way that selection of best genotypes is possible to use them hybridization programme.

Table 1. List of promising eggplant genotypes with significant features used for organoleptic evaluation as first set (Set-I)

S. No.	Genotype	Botanical identity	Biological status	Specific features of fruits	Stress resistance	Source of germplasm
1	Arka Keshav	*S. melongena*	Modern cultivar	Black violet, elongated fruits	BWR	IIHR, Bangalore
2	IC255756	*S. melongena*	Primitive cultivar	Green, glossy elongated fruits	BWR	NBPGR, Regional Station (RS), Vellanikkara
3	IC256708	*S. melongena*	Landrace	Purple colour with stripes, oval fruits	BWR	
4	IC333527	Introgression#	Wild	Green colour with stripes, round fruits	BWR	
5	IC383695	*S. melongena*	Landrace	Purple colour with stripes, oval to round fruits	BWR	
6	IC421190	*S. melongena*	Landrace	Milk white colour with stripes, oval to round	BWR	
7	IC599705	*S. insanum*	Wild relative	Green, round, small (~2.5 cm) and striped fruits	BWR	
8	IC624213	*S. violaceum*	Wild relative	Green, small round (~1 cm), netted stripes on fruit surface	BWR	
9	IC624237	*S. melongena*	Primitive cultivar	Long green fruits with stripes on fruit surface	BWR	
10	IC624240	*S. melongena*	Primitive cultivar	Purple, elongated fruits	BWR	
11	IC626119	*S. melongena*	Primitive cultivar	Long green fruits with stripes on fruit surface	BWR	
12	IC636521	*S. melongena*	Landrace	Whitish to light glossy faded purple or rose colour fruit, oval shape	BWR	
13	IC636524	*S. melongena*	Landrace	Green round to oval fruits with stripes on surface	BWR	
14	IC641515	Introgression#	Wild	Green round fruits with stripes on surface	BWR	
15	IC641518	*S. melongena*	Landrace	Milk white in colour, round to egg shaped fruits	BWR	
16	IC641521	Introgression#	Wild	Small (~3.5 cm), green fruit stripes on surface	BWR	
17	IC618016	*S. melongena*	Landrace	Purple to light blackish colour at immature to commercial ripens stage and turned to faded green colour, round fruits with pericarp thickness (~1.0 cm)	BWR, FBR	
18	Vengeri	*S. melongena*	Landrace	Purple coloured at immature to commercial ripens stage & turned to faded green colour with maturity, long fruits	BWR, FBR	KAU, Vellanikkara
19	Haritha	*S. melongena*	Modern cultivar	Green colour with glossy nature, Elongated fruits	BWR	
20	Ponni	*S. melongena*	Modern cultivar	Elongated green colour with non glossy fruits	BWR, FBS	

IC-Indigenous collection; IIHR-Indian Institute of Horticultural Research; NBPGR-National Bureau of Plant Genetic Resources; KAU-Kerala Agricultural University.#-Introgression: arises may be due to spontaneous or natural hybridization between *Solanum melongena* X *Solanum insanum* by insect pollinators or wind. BWR-Bacterial wilt resistant; FBR-Fruit borer resistant; FBS-Fruit borer susceptible

Table 2. List of eggplant parents, hybrids and popular varieties used for organoleptic evaluation as second set

S. No.	Genotypes	Stress resistance	Specific features
Parental genotypes			
1	Ponni	BWR, FBS	Green colour with non-glossy nature, elongated cylindrical fruits
2	Vengeri	BWR, FBR	Purple colour at immature to commercial ripens stage and turned to faded green colour with maturity, long cylindrical fruits, 1 to 2 prickles on calyx
3	IC618016	BWR, FBR	Purple to light blackish colour at immature to commercial ripened stage and turned to faded green colour with maturity, round fruits with thick pericarp (~.8-1.0 cm)
4	IC636521	BWR, FBT	Whitish to light glossy faded purple or rose colour fruit, oval to pear shape
5	IC624240	BWR, FBT	Purple, elongated fruits
F_1 hybrids			
6	Ponni x Vengeri	BWR, FBT	Purple colour fruits with green patches, elongated fruits
7	Ponni x IC618016	BWR, FBT	Purple colour fruits with green patches, fruits are obovate in shape
8	Ponni x IC636521	BWR, FBT	Green colour fruits with purple colour stripes and patches, fruits are elongated to club shaped
9	Ponni x IC624240	BWR, FBT	Purple colour fruits with green patches, elongated to club shaped fruits
10	Vengeri x IC618016	BWR, FBT	Purple glossy colour fruits with small green patches at bottom base of fruits, medium long obovate fruit shaped
11	Vengeri x IC636521	BWR, FBT	Purple colour, glossy (purple to rose shaded purple) fruits with small green patches at bottom tip of fruits, medium long obovate fruit shaped
12	Vengeri x IC624240	BWR, FBT	Purple colour long fruits with 1-2 prickles on calyx
13	IC618016 x IC636521	BWR, FBT	Purple colour fruits with green patches, round fruits
14	IC618016 x IC624240	BWR, FBT	Purple colour fruits with green patches, oval fruits
15	IC636521 x IC624240	BWR, FBT	Purple colour medium long fruits
Check varieties			
16	Haritha	BWR, FBS	Elongated light green fruits popular variety
17	Surya	BWR, FBS	Oval, medium sized, glossy violet fruits popular variety
18	Neelima (F_1 hybrid)	BWR, FBS	Oval to round, large, glossy violet fruits

BWR-Bacterial wilt resistant; FBR-Fruit borer resistant; FBS-Fruit borer susceptible

RESULTS AND DISCUSSION

The evaluation of genotypes for organoleptic descriptors helps to identify consumer preferred cultivars. Hence, bacterial wilt resistant eggplant genotypes were subjected to organoleptic evaluation as first set (Set-I) based on QDA. Next, ten F_1 hybrids developed using these genotypes were evaluated for same organoleptic descriptors as second set (Set-II). The results were presented as mean values with mean ranks in brackets in **Table 3** (Set-I) and **Table 5** (Set-II).

Organoleptic evaluation of first set eggplant genotypes: Organoleptic evaluation of eggplant genotypes tested using a two-point hedonic scale showed that there was a significant difference ($p<0.05$) for most of the descriptor states (**Table 3**). According to Gajewski and Arasimowicz (2004), the organoleptic evaluation of eggplant provides essential information on the quality characteristics of fruits consumers desire. The organoleptic descriptors like odour, appearance, texture, flavour and taste, overall quality are crucial factors in determining the quality and acceptability of eggplant cultivars. Among various methods reported for organoleptic evaluation, quantitative descriptive analysis (QDA) was often used for a detailed explanation of a product (Eze *et al.,* 2012; Dery *et al.,* 2021; Nakitto *et al.,* 2022).

Odour - Among the seven odour attributes, three, *viz.,* sharp odour, odour of hay and off-odour, showed significant differences between the genotypes (Table 4). The sharp odour was recorded as pungent and spicy odour. Among the genotypes the strongest pungency (1.34), odour was shown in IC624213 (*S. violaceum*), while the least (0.43) sharp odour was in Haritha (*S. melongena*). The panel found that IC599705 (*S. insanum*) had intense (0.81) odour of hay characteristic (odour of long stored hay) while the less intense (0.12) was observed in IC255756 (*S. melongena*). The off-odour was measured as the untypical odour of eggplant fruit, and IC624213 (*S. violaceum*) had intense (0.79) while IC636521 (*S. melongena*) had very low intense (0.11) off

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odour. Remaining four odour descriptors *viz.,* odour of steamed potatoes (0.17-0.61), odour of boiled fungi (0.11-0.68), odour of plum jam (0.09-0.58), odour of boiled vegetables (0.29-0.64) were not shown any significant variation among genotypes.

In the first set odour descriptors showed significant difference among the fruit samples of eggplant genotypes because the first set comprises of eggplant crop related species like *S. violaceum* (IC624213) and *S. insanum* (IC599705), which exhibited intensive odour. Interestingly, the presence of wild relatives does not make much difference for other odour descriptors like odour of steamed potatoes, odour of boiled fungi, odour of plum jam and odour of boiled vegetables.

Appearance **-**The appearance of eggplant genotypes was assessed by flesh colour and number of seeds in the flesh, and there was significant variation among genotypes (**Table 3**). The flesh colour was measured as visual evaluation of flesh colour as light brown (0) and dark brown (2), and among the genotypes least browning (0.47) was observed in IC624237 (*S. melongena*), and more browning (1.35) was exhibited by IC333527 (Introgressed line). Next, fewer number of seeds (0.62, 0.64) was observed in IC618016 and Vengeri (*S. melongena*), while, more seeds in the flesh (1.82) were observed in IC333527.

The appearance of eggplant is an important descriptor, and it indicates susceptibility of vegetable to enzymatic browning after exposure to oxygen. The fruits that are non-brown immediately after cutting were preferred by panelists, which may be considered as safe to eat. The introgressed line (IC333527) only showed high browning and it may be transferred from progenitor *S. insanum, as mean browning value of IC599705 (S. insanum) (1.25) and IC333527 (1.35) was similar.* Enzymatic browning was a major post-harvest problem, and it was determined by the enzymatic activity of peroxidase and polyphenol oxidase enzymes (Liu *et al.,* 2021). The more number of seeds in the flesh is a significant feature of eggplant wild relatives (progenitor), and it was observed in introgressed line (IC333527).

Texture **-** Out of four texture attributes rated two, *viz.,* flesh firmness and skin hardness, exhibited significant variation. The soft flesh was found in Haritha (0.53) and IC624237 (0.64). Meanwhile, more flesh firmness was exhibited by introgressed line IC333527 (1.49). The eggplant genotype IC641518 (*S. melongena*) demanded a maximum (1.57) degree of force needed to bite skin (Hard) while measuring skin hardness and the soft skin hardiness was recorded by Haritha (0.72) (*S. melongena*). The panel measured the flesh juiciness as the amount of liquid released when the sample was chewed, and there was no significant difference (0.63-0.97) among the genotypes. Similarly, flesh fibrousness was measured as mouth feel of flesh homogeneousness during chewing of the fried sample and there was no significant variation (0.36-0.83) among the genotypes. The difference in flesh firmness and skin hardness of eggplant might be due to the variation in the pericarp thickness and flesh density of the fruits.

Flavour and taste **-** Among the six flavour and taste descriptor classess, three *viz.,* bitter taste, pungent flavor, and off-flavour showed significant variation, while other threes *viz.,* sweet taste (0.34-91), flavour of boiled fungi (0.26-0.61), flavor of roasted fruit (0.38-0.86) showed least variation. The intensity of the bitter taste was low in IC618016 (0.26) Haritha and IC421190 of *S. melongena*. The high intensity (1.92) of bitterness was felt in fried fruits of IC624213 (*S. violaceum*). The pungent flavor was measured as the flavour which gives an impression of burning on the tongue by the fried fruits. It was recorded as low in Haritha (0.10), IC255756 (0.20) and IC636521 (0.24) (*S. melongena*). The more intensity of pungent flavour was recorded by IC624213 (1.31) (*S. violaceum*). The off-flavour was measured as the untypical flavour of eggplant fruit. It was very low intensive in IC255756 (0.16), Haritha (0.18) and IC636521 (0.24) all of *S. melongena group.* In contrast, the more intensive (1.56) off-flavour was recorded in IC624213 (*S. violaceum*).

The fruits of eggplant genotypes were differed in bitter taste, pungent flavor, and off-flavour and not differed for sweet taste, flavour of boiled fungi, and flavor of roasted fruit. The low intense flavour and taste was recorded for bitter taste (IC618016, Haritha, IC421190), pungent flavor (IC618016, Haritha, IC421190), and off-flavour (IC255756, Haritha, IC636521) in the genotypes under *S. melongena. This may be due to the selection of these genotypes during the course of evolution or domestication. The high intensive* bitter taste, pungent flavor, and off-flavour was recorded in the accession belonging to *S. violaceum* (IC624213) a crop wild relative. However, these fruits are utilised by local tribal people in north east India to remove intestinal worms (Payum *et al*., 2014).

Overall quality- The panelists estimated the overall quality of eggplant genotypes by recording the overall quality of fruits and market preference. These showed significant variation and, in the set-I, the genotypes belonging to *S. melongena* showed high quality in following order *i.e.,* IC255756 (1.54), Vengeri (1.49), IC626119 (1.38), IC636521 (1.35), Haritha (1.33), IC624240 (1.32), Ponni (1.30) and IC618016 (1.21) based on the general sensory quality impression of fruits. Market preference was measured based on appearance of fruits. Among the set-I genotypes, the accessions belonging to *S. melongena* were picked by the panel as high market preferences in the following order, *i.e.,* IC255756 (1.68), Ponni (1.52), Haritha (1.51), Vengeri (1.50), IC618016 (1.41) and IC624240 (1.40). The accession IC624213 (*S. violaceum*) obtained the lowest overall quality (0.08) and market preference (0.18).

The cultivars displayed different colors due to genetic characteristics or physiological stages. The genotypes with glossier green colour (Haritha, IC255756), green (Ponni) and various shades of purple (Vengeri, IC624240, IC618016) were most appealing to the panelists. The two other accessions Green with striped (IC626119) and white to rose or light purple faded colour (IC636521) were having less market preference, even though they had higher sensory quality impression. The accession belonging to *S. violaceum (*IC624213) was not preferred by panelists may be due to its small round fruit with more *intensive* bitter taste, pungent and off-flavour.

Oorganoleptic evaluation of first set showed that the glossy appearance, flavour and taste descriptors varied significantly among the eggplant genotypes, which may contributed mostly to the overall quality and acceptability of eggplant fruits by panelists as suggested by Eze *et al.* (2012).

Yield per plant (g) **–** The ANOVA revealed significant ($p<0.05$) difference among the eggplant genotypes of yield per plant (g) (**Table 3**). Out of the 20 genotypes, the maximum yield per plant was found in IC636521 (1064.90 g) followed by IC624240 (1064.90 g) while the lowest yield was expressed by IC636524 (181.85 g). The ANVOA of yield per plant among these bacterial wilt resistant genotypes indicates the presence of significant variability which help us to further study to select better genotypes by comparing with organoleptic evaluation for a successful crop improvement programme.

Construction of selection index in first set:The mean values of yield per plant, overall quality of fruits and market preference of fruits were used as component characters. Based on the genotype mean and post-hoc test for each trait, the genotypes were arranged in groups and topmost group with the maximum mean was given a score of one and so on. Based on the mean values of this scores the genotypes, ranks were assigned to each genotype (**Table 4)**. Among the 20 genotypes, IC636521 (1.75) obtained top score and followed by IC624240 (1.92), Ponni (2.50), Vengeri (2.67), IC618016 (2.67), IC255756 (3.0), IC626119 (3.10) and Haritha (3.17). From these,

Table 3. Average scores of descriptive organoleptic evaluation (Odour, Appearance, Texture, Flavour, Taste and Overall quality) and yield per plant (g) of eggplant cultivars

S. No.	Genotypes	Odour descriptors							Appearance descriptors	Texture descriptors		
		Sharp odour	Odour of steamed potatoes	Odour of boiled fungi	Odour of hay	Odour of plum jam	Odour of boiled vegetables	Off-odour	Flesh colour	Number of seeds in flesh	Flesh firmness	Flesh juiciness
1	Arka Keshav	0.66^{bcde}	0.49	0.39	0.36^{ab}	0.29	0.52	0.14^{bc}	0.91^{abc}	1.02^{efg}	0.86^{bcde}	0.97
2	IC255756	0.60^{bcde}	0.25	0.17	0.12^{b}	0.09	0.32	0.17^{bc}	0.84^{abc}	0.82^{fgh}	0.66^{de}	0.75
3	IC256708	0.67^{bcde}	0.58	0.34	0.21^{b}	0.21	0.57	0.22^{abc}	0.78^{abc}	1.35^{abcdef}	1.08^{abcde}	0.63
4	IC333527	1.05^{abcd}	0.59	0.47	0.47^{ab}	0.39	0.59	0.64^{abc}	1.35^{a}	1.82^{a}	1.49^{a}	0.83
5	IC383695	0.46^{de}	0.27	0.11	0.29^{ab}	0.20	0.29	0.18^{bc}	0.90^{abc}	1.12^{cdefg}	0.84^{bcde}	0.75
6	IC421190	0.97^{abcde}	0.37	0.21	0.43^{ab}	0.23	0.56	0.61^{abc}	0.69^{abc}	1.24^{bcdef}	1.29^{abc}	0.77
7	IC599705	1.16^{ab}	0.48	0.38	0.81^{a}	0.44	0.64	0.71^{ab}	1.25^{ab}	1.68^{abc}	1.43^{ab}	0.69
8	IC624213	1.34^{a}	0.62	0.66	0.58^{ab}	0.39	0.51	0.79^{a}	1.03^{abc}	1.80^{ab}	1.30^{abc}	0.91
9	IC624237	0.72^{bcde}	0.24	0.24	0.28^{ab}	0.37	0.42	0.17^{bc}	0.47^{c}	0.92^{fgh}	0.64^{e}	0.75
10	IC624240	0.60^{bcde}	0.45	0.24	0.33^{ab}	0.15	0.47	0.28^{abc}	0.75^{abc}	0.45^{h}	0.73^{cde}	0.66
11	IC626119	0.76^{abcde}	0.41	0.22	0.21^{ab}	0.19	0.46	0.23^{abc}	0.64^{bc}	1.14^{cdefg}	0.98^{abcde}	0.81
12	IC636521	0.63^{bcde}	0.38	0.35	0.22^{ab}	0.25	0.53	0.11^{c}	0.85^{abc}	0.92^{fgh}	1.13^{abcde}	0.83
13	IC636524	0.89^{abcde}	0.61	0.43	0.57^{ab}	0.29	0.54	0.64^{abc}	0.83^{abc}	1.55^{abcde}	1.37^{ab}	0.78
14	IC641515	1.09^{abc}	0.35	0.68	0.66^{ab}	0.29	0.41	0.62^{abc}	0.90^{abc}	1.56^{abcde}	1.27^{abcd}	0.67
15	IC641518	0.67^{bcde}	0.39	0.26	0.32^{ab}	0.33	0.55	0.25^{abc}	0.71^{abc}	1.02^{efg}	1.30^{abc}	0.72
16	IC642521	0.63^{bcde}	0.54	0.35	0.49^{ab}	0.32	0.62	0.63^{abc}	1.05^{abc}	1.59^{abcd}	1.34^{ab}	0.90
17	IC618016	0.65^{bcde}	0.34	0.19	0.25^{ab}	0.58	0.56	0.28^{abc}	0.75^{abc}	0.62^{gh}	1.04^{abcde}	0.91
18	Vengeri	0.57^{bcde}	0.31	0.26	0.36^{ab}	0.24	0.34	0.18^{bc}	0.62^{bc}	0.64^{gh}	0.96^{abcde}	0.83
19	Ponni	0.51^{cde}	0.35	0.23	0.24^{ab}	0.45	0.44	0.27^{abc}	0.67^{abc}	0.82^{fgh}	1.06^{abcde}	0.66
20	Haritha	0.43^{e}	0.17	0.22	0.25^{ab}	0.25	0.48	0.16^{bc}	0.66^{abc}	0.81^{fgh}	0.53^{e}	0.76
	P value	0.00*	0.26^{NS}	0.052^{NS}	0.003*	0.55^{NS}	0.93^{NS}	0.00*	0.00*	0.00*	0.00*	0.94^{NS}

* – Significant at 5% level ($p<0.05$); NS – Non Significant ($p>0.05$)

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Table 3. Continue..

S. No.	Genotypes	Texture descriptors		Flavour &taste descriptors						Overall quality descriptors		Yield per plant (g)
		Flesh fibrousness	Skin hardness	Sweet taste	Flavour of boiled fungi	Flavor of roasted fruit	Bitter taste	Pungent flavor	Off-flavour	Overall quality	Market preference of fruit	
1	Arka Keshav	0.72	0.78^{def}	0.84	0.49	0.85	0.49^{defg}	0.46^{cde}	0.37^{cd}	1.34^{abcd}	1.21^{abcde}	404.74^{h}
2	IC255756	0.48	0.75^{ef}	0.81	0.26	0.68	0.32^{efg}	0.20^{e}	0.16^{d}	1.54^{a}	1.68^{a}	499.27^{g}
3	IC256708	0.74	1.36^{abcdef}	0.53	0.58	0.38	0.82^{cdef}	1.06^{abc}	0.84^{bcd}	0.73^{ef}	1.02^{bcde}	298.22^{ij}
4	IC333527	0.83	1.48^{ab}	0.91	0.60	0.61	1.04^{bcd}	0.92^{abcd}	0.70^{bcd}	0.57^{fg}	0.76^{def}	328.53^{i}
5	IC383695	0.81	0.94^{abcdef}	0.77	0.49	0.46	0.92^{bcde}	0.60^{bcde}	0.72^{bcd}	1.18^{abcde}	0.96^{bcde}	507.31^{g}
6	IC421190	0.77	1.31^{abcdef}	0.59	0.31	0.46	0.27^{fg}	0.41^{cde}	0.52^{cd}	0.86^{cdef}	1.09^{abcde}	224.86^{k}
7	IC599705	0.70	1.45^{abc}	0.34	0.47	0.86	1.41^{abc}	0.95^{abcd}	1.26^{ab}	1.16^{abcde}	1.19^{abcde}	226.33^{k}
8	IC624213	0.72	1.47^{abc}	0.44	0.61	0.54	1.92^{a}	1.31^{a}	1.56^{a}	0.08^{g}	0.18^{f}	459.42^{gh}
9	IC624237	0.56	0.84^{cdef}	0.73	0.43	0.68	0.34^{efg}	0.59^{bcde}	0.37^{cd}	1.08^{abcdef}	1.38^{abcd}	246.65^{jk}
10	IC624240	0.65	1.07^{abcdef}	0.69	0.45	0.65	0.59^{defg}	0.33^{de}	0.36^{cd}	1.32^{abcd}	1.40^{abc}	1064.90^{b}
11	IC626119	0.73	1.04^{abcdef}	0.97	0.32	0.59	0.34^{efg}	0.49^{cde}	0.42^{cd}	1.38^{abc}	1.09^{abcde}	804.24^{e}
12	IC636521	0.72	1.13^{abcdef}	0.63	0.39	0.64	0.51^{defg}	0.24^{e}	0.24^{d}	1.35^{abcd}	1.20^{abcde}	1114.14^{a}
13	IC636524	0.78	1.53^{ab}	0.72	0.55	0.63	1.54^{ab}	1.20^{ab}	1.27^{ab}	0.56^{fg}	0.80^{cdef}	181.85^{k}
14	IC641515	0.70	1.39^{abcde}	0.55	0.54	0.76	0.87^{cdef}	0.99^{abcd}	1.01^{abc}	0.70^{ef}	0.60^{ef}	300.92^{ij}
15	IC641518	0.81	1.57^{a}	0.56	0.39	0.66	0.48^{defg}	0.45^{cde}	0.46^{cd}	0.82^{def}	1.30^{abcd}	460.47^{gh}
16	IC642521	0.76	1.42^{abcd}	0.79	0.47	0.47	0.58^{defg}	0.53^{bcde}	0.42^{cd}	0.99^{bcdef}	0.62^{ef}	924.63^{c}
17	IC618016	0.58	1.32^{abcdef}	0.74	0.41	0.58	0.26^{fg}	0.50^{cde}	0.33^{cd}	1.21^{abcde}	1.41^{abc}	832.50^{d}
18	Vengeri	0.73	1.05^{abcdef}	0.84	0.44	0.72	0.54^{defg}	0.44^{cde}	0.42^{cd}	1.49^{ab}	1.50^{ab}	777.86^{e}
19	Ponni	0.44	0.89^{bcdef}	0.63	0.40	0.66	0.31^{efg}	0.61^{abcde}	0.35^{cd}	1.30^{abcd}	1.52^{ab}	856.17^{d}
20	Haritha	0.36	0.72^{f}	0.81	0.35	0.55	0.26^{fg}	0.10^{e}	0.18^{d}	1.33^{abcd}	1.51^{ab}	673.20^{f}
	P value	0.55^{NS}	0.00*	0.42^{NS}	0.97^{NS}	0.84^{NS}	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*

* –Significant at 5% level (p<0.05); NS – Non Significant (p>0.05)

Table 4. Comparison and ranking of first set eggplant genotypes based on selection index

S. No.	Genotypes	Total score	Rank	S. No.	Genotypes	Total score	Rank
1	Arka keshav	4.08	IX	11	IC626119	3.10	VI
2	IC255756	3.00	V	12	IC636521	1.75	I
3	IC256708	6.00	XIV	13	IC636524	7.17	XVII
4	IC333527	6.75	XV	14	IC641515	6.83	XVI
5	IC383695	4.08	IX	15	IC641518	4.75	X
6	IC421190	5.75	XIII	16	IC642521	3.83	VIII
7	IC599705	5.17	XII	17	IC618016	2.67	IV
8	IC624213	6.83	XVI	18	Vengeri	2.67	IV
9	IC624237	5.00	XI	19	Ponni	2.50	III
10	IC624240	1.92	II	20	Haritha	3.17	VII

top five genotypes *viz.,* IC636521, IC624240, Ponni, Vengeri, and IC618016 were selected for hybridization. These five parents were crossed in half diallele fashion to produce ten hybrids and they were tested for organoleptic evaluation along with popular cultivars Haritha, Surya and Neelima (F_1 hybrid) and parents as second set in 2024.

Organoleptic evaluation of eggplant second set: The organoleptic evaluation of eggplant hybrids, parents and check varieties (Set-II) (*S. melongena*) using a two-point hedonic scale showed no significant difference (p>0.05) among the entries for most of the descriptors (**Table 5**).

Odour **-** The seven odour attributes *viz.,* sharp odour (0.30-0.78), odour of steamed potatoes (0.22-0.48), odour of boiled fungi (0.10-0.30), odour of hay (0.10-0.36), odour of plum jam (0.06-0.60), odour of boiled vegetables (0.38-0.75) and off-odour (0.05-0.30) showed no variation among the set-II materials tested. This can be due to the fact that the parents were of uniform character.

Appearance **-** There was significant variance across genotypes for flesh color and the number of seeds in flesh (**Table 5**). Among the hybrids, Ponni x IC636521 (0.59) showed the least browning, while Vengeri x IC618016 (1.23) showed the most browning. While other hybrids (0.80-1.18) had similar flesh colour as that of Haritha, Surya, Neelima and parents (0.68-1.15). Fewer seeds in the flesh were observed in parental genotypes IC624240 (0.50) and IC618016 (0.52), while there were more seeds in the flesh of Neelima (1.60). Among the hybrids the number of seeds in flesh ranged between 0.90 (Ponni x Vengeri) to 1.31 (Ponni x IC618016). Number of seeds in the flesh varied as the parents involved had various levels of seeds in flesh.

Texture **-** Among the four texture descriptors flesh firmness and skin hardness showed significant difference among genotypes. Among the hybrids Vengeri x IC636521 (0.66) had the least flesh firmness or soft flesh, while Surya (1.19) had hard flesh. The hybrid Ponni x IC618016 (1.46) required greater degree of force to bite skin while evaluating skin hardness, while, Haritha (0.59) had soft skin. The flesh juiciness and flesh fibrousness showed no significant difference between genotypes.

The panelists found softer flesh in hybrid Vengeri x IC63652and there was no difference among other hybrids. Slight variation observed with parents and check varieties may be due to the variation in the flesh density. For texture descriptors like skin hardness , greater variation present in hybrids may be due to the variation in the thickness of pericarp of the fruits of parents (IC618016, IC624240, IC636521 had more pericarp thickness *i.e.,* 0.7cm-1.0 cm).

Table 5. Average scores of descriptive organoleptic evaluation (Odour, Appearance, Texture, Flavour, Taste and Overall quality) and yield per plant (g) of eggplant breeding progenies (hybrids) with parents and local cultivars

S. No.	Genotypes	Odour descriptors							Appearance descriptors		Texture descriptors	
		Sharp odour	Odour of steamed potatoes	Odour of boiled fungi	Odour of hay	Odour of plum jam	Odour of boiled vegetables	Off-odour	Flesh colour	Number of seeds in flesh	Flesh firmness	Flesh juiciness
	F_1 hybrids											
1	Ponni x Vengeri	0.51	0.28	0.15	0.32	0.34	0.62	0.19	0.94^{ab}	0.90^{def}	0.95^{abc}	1.15
2	Ponni x IC618016	0.44	0.45	0.18	0.24	0.24	0.63	0.17	0.84^{ab}	1.31^{abc}	0.98^{abc}	0.94
3	Ponni x IC636521	0.30	0.44	0.21	0.26	0.28	0.41	0.05	0.59^{b}	0.92^{def}	0.89^{abc}	0.86
4	Ponni x IC624240	0.41	0.24	0.14	0.28	0.25	0.38	0.14	1.18^{ab}	1.08^{cd}	1.10^{ab}	0.81
5	Vengeri x IC618016	0.51	0.46	0.29	0.20	0.24	0.57	0.28	1.23^{a}	1.02^{cdef}	0.98^{abc}	1.01
6	Vengeri x IC636521	0.40	0.42	0.26	0.18	0.20	0.60	0.06	1.11^{ab}	1.04^{cde}	0.66^{c}	0.97
7	Vengeri x IC624240	0.44	0.29	0.18	0.10	0.28	0.55	0.08	1.12^{ab}	1.18^{bcd}	0.86^{abc}	0.98
8	IC618016 x IC636521	0.57	0.43	0.17	0.17	0.25	0.66	0.24	0.80^{ab}	1.09^{cd}	1.05^{abc}	3.59
9	IC618016 x IC624240	0.78	0.37	0.21	0.17	0.22	0.63	0.28	0.96^{ab}	1.01^{cdef}	0.97^{abc}	1.10
10	IC636521 x IC624240	0.40	0.36	0.21	0.14	0.19	0.51	0.07	1.07^{ab}	0.97^{cdef}	0.92^{abc}	0.84
	Local cultivars											
11	Haritha	0.50	0.22	0.22	0.19	0.26	0.53	0.05	0.87^{ab}	0.97^{cdef}	0.77^{bc}	1.29
12	Surya	0.77	0.45	0.24	0.27	0.30	0.41	0.05	1.15^{ab}	1.51^{ab}	1.19^{a}	0.96
13	Neelima (F_1 hybrid)	0.56	0.48	0.16	0.36	0.06	0.47	0.17	1.13^{ab}	1.60^{a}	1.09^{ab}	0.83
	Parents											
14	Ponni	0.46	0.34	0.10	0.17	0.28	0.56	0.13	0.97^{ab}	1.00^{cdef}	1.11^{ab}	0.84
15	Vengeri	0.61	0.39	0.16	0.33	0.12	0.48	0.10	1.11^{ab}	0.55^{ef}	0.95^{abc}	0.96
16	IC618016	0.58	0.23	0.20	0.25	0.60	0.60	0.23	0.68^{ab}	0.52^{f}	1.05^{abc}	0.96
17	IC636521	0.46	0.47	0.18	0.20	0.47	0.75	0.08	0.75^{ab}	1.12^{cd}	0.88^{abc}	1.06
18	IC624240	0.47	0.36	0.18	0.25	0.30	0.53	0.30	0.79^{ab}	0.50^{f}	0.74^{bc}	0.85
	P value	0.59^{NS}	0.94^{NS}	0.99^{NS}	0.86^{NS}	0.21^{NS}	0.90^{NS}	0.24^{NS}	0.004*	0.00*	0.04*	0.33^{NS}

* –Significant at 5% level (p<0.05); NS – Non Significant (p>0.05)

Table 5. Continue...

S. No.	Genotypes	Texture descriptors		Flavour and taste descriptors						Overall quality descriptors		Yield per plant (g)
		Flesh fibrousness	Skin hardness	Sweet taste	Flavour of boiled fungi	Flavor of roasted fruit	Bitter taste	Pungent flavor	Off-flavour	Overall quality	Market preference of fruit	
	F_1 hybrids											
1	Ponni x Vengeri	0.74	1.00^{abcd}	0.77	0.45	0.73	0.32^{ab}	0.35	0.25	1.20^{abc}	1.09^{ab}	811.42^{ef}
2	Ponni x IC618016	0.77	1.46^{a}	0.77	0.28	0.73	0.14^{ab}	0.24	0.17	1.23^{abc}	1.20^{ab}	814.80^{ef}
3	Ponni x IC636521	0.93	1.40^{ab}	0.53	0.33	0.38	0.40^{ab}	0.37	0.30	1.07^{abc}	1.10^{ab}	997.11^{b}
4	Ponni x IC624240	0.90	1.36^{abc}	0.72	0.33	0.49	0.49^{ab}	0.51	0.26	0.92^{c}	0.97^{b}	917.27^{c}
5	Vengeri x IC618016	1.01	1.41^{ab}	0.82	0.40	0.42	0.23^{ab}	0.19	0.03	1.13^{abc}	1.20^{ab}	769.02^{f}
6	Vengeri x IC636521	0.63	0.84^{abcd}	0.80	0.33	0.41	0.11^{b}	0.17	0.07	1.57^{a}	1.56^{a}	1188.20^{a}
7	Vengeri x IC624240	0.63	0.80^{bcd}	0.48	0.30	0.48	0.61^{a}	0.46	0.35	0.96^{c}	1.17^{ab}	1053.68^{b}
8	IC618016 x IC636521	0.72	0.93^{abcd}	0.88	0.26	0.55	0.23^{ab}	0.25	0.15	1.30^{abc}	1.31^{ab}	898.53^{cd}
9	IC618016 x IC624240	0.67	0.71^{cd}	0.96	0.38	0.75	0.11^{b}	0.31	0.09	1.36^{abc}	1.47^{ab}	1040.40^{b}
10	IC636521 x IC624240	0.77	1.07^{abcd}	0.61	0.41	0.44	0.31^{ab}	0.24	0.16	1.15^{abc}	1.12^{ab}	1028.32^{b}
	Local cultivars											
11	Haritha	0.59	0.59^{d}	0.81	0.41	0.43	0.13^{b}	0.24	0.09	1.42^{ab}	1.50^{ab}	638.55^{g}
12	Surya	0.93	1.23^{abc}	0.62	0.41	0.39	0.30^{ab}	0.23	0.15	1.30^{abc}	1.31^{ab}	671.00^{g}
13	Neelima (F_1 hybrid)	0.67	1.05^{abcd}	0.80	0.38	0.36	0.27^{ab}	0.27	0.30	1.11^{abc}	1.24^{ab}	825.83^{ef}
	Parents											
14	Ponni	0.83	0.91^{abcd}	0.63	0.32	0.39	0.50^{ab}	0.31	0.18	1.02^{bc}	1.04^{ab}	781.41^{ef}
15	Vengeri	0.74	1.03^{abcd}	0.49	0.34	0.50	0.43^{ab}	0.43	0.17	1.08^{abc}	1.20^{ab}	642.95^{g}
16	IC618016	0.63	1.34^{abc}	0.81	0.35	0.54	0.18^{ab}	0.39	0.23	0.99^{bc}	1.33^{ab}	844.73^{de}
17	IC636521	0.82	1.15^{abcd}	0.97	0.29	0.70	0.13^{b}	0.21	0.10	1.27^{abc}	1.34^{ab}	1017.00^{b}
18	IC624240	0.90	1.22^{abcd}	0.58	0.24	0.45	0.44^{ab}	0.54	0.28	1.06^{abc}	1.01^{ab}	988.55^{b}
	P value	0.46^{NS}	0.00*	0.17^{NS}	1.0^{NS}	0.37^{NS}	0.002*	0.35^{NS}	0.27^{NS}	0.00*	0.006*	0.00*

* –Significant at 5% level ($p<0.05$); NS – Non Significant ($p>0.05$)

Flavour and taste - Out of six flavour and taste descriptors, five *viz.,* sweet taste (0.48-0.97), flavour of boiled fungi (0.26-0.0.45), flavor of roasted fruit (0.36-0.75), pungent flavor (0.17-0.51), and off flavour (0.03-0.35) did not show any significant variation between the genotypes. The bitter taste descriptor only showed considerable variation among the genotypes with a range from 0.11 (Vengeri x IC636521, IC618016 x IC624240 and it was at par with Haritha) to 0.61 (Vengeri x IC624240).

The non-significant difference for flavour and taste descriptors indicate that the hybrids and parents had similar consumptive attributes to check varieties and they are well appealing to the panelists. Even though there was significant difference for bitter taste among the materials its range was from very low to low (0.11 to 0.61), not intensive and it was in the acceptable range.

Overall quality **-** The overall quality of fruits was measured as the sensory quality impression of fruits and among the set-II genotypes, highest overall quality was showed by Vengeri x IC636521 (1.57) followed by Haritha (1.42); IC618016 x IC624240 (1.36), IC618016 x IC636521 (1.30), IC636521(1.30), Surya (1.27), Ponni x IC618016 (1.23), Ponni x Vengeri (1.20), IC636521 x IC624240 (1.15), Vengeri x IC618016 (1.13), Neelima (1.11), Vengeri (1.08), Ponni x IC636521 (1.07) and IC624240 (1.06). Similarly to overall quality of fruits Vengeri x IC636521 (1.56) showed by highest market preference of fruits followed by other hybrids (except Ponni x IC624240) and they are at par with the parents and check varieties. The panelists measured overall quality attributes and selected Vengeri x IC636521 as superior one over the other entries. The other hybrids also obtained similar scorings as of parents and check varieties.

Yield per plant (g) - The ANOVA revealed significant ($p<0.05$) difference among the second set of eggplant genotypes for yield per plant (g) (**Table 5**). Among the second set genotypes, the maximum yield per plant was reported in Vengeri x IC636521 (1188.20 g) and it was superior to the parents and local checks. Out of ten hybrids, seven reported higher yield over local check varieties (Haritha, Surya) and F_1 hybrid (Neelima). Two more hybrids (Ponni x Vengeri, Ponni x IC618016) reported higher yield over local check varieties (Haritha, Surya) and at par with F_1 hybrid (Neelima). The lowest yield was found in Vengeri x IC618016 (769.02 g). Hence, these findings validated the accurate selection of first set of materials based on organoleptic evaluation and yield which lead to production of consumer acceptable hybrids.

Eggplant fruits had good phytonutrients with a low calorific profile or value. They also provide essential vitamins and minerals that are beneficial to human health. The appearance of fruits and organoleptic attributes mainly determine consumer preference. This study examined and selected a few consumer preferred eggplant genotypes from a set of bacterial wilt resistant resistant genotypes based on organoleptic evaluation. Genotypes having fruits with the high overall quality and better yield were selected and they were utilised to develop 10 F_1 hybrids. The hybrid, Vengeri x IC636521 had high-quality fruits with more market preference. Most of the other hybrids (seven) also obtained good overall quality with better market preference at par with check varieties and parents. These breeding progenies can be popularized among the consumers of Kerala after conducting the multi-location tests for agronomic yield performance. The study highlights the significant role of organoleptic evaluation in the early selection of genotypes for development of eggplant hybrids with consumer acceptance.

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