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EVALUATION OF *MOMORDICA CYMBALARIA* HOOK. FENZL. GENOTYPES FOR QUALITY TRAITS

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ABSTRACT

The present experiment, titled "Evaluation of *Momordica cymbalaria* Hook. Fenzl. genotypes for quality traits" was conducted at the College of Horticulture, Anantharajupeta, Dr. Y.S.R. Horticultural University, Andhra Pradesh, during 2023-24. The experiment with forty accessions collected from various locations was laid out in a completely randomized design with two replications. Analysis of variance revealed that the genotypes differed significantly for all the quality parameters. The TSS in fruits of 40 *Momordica cymbalaria* accessions ranged from 2.36 to 5.84 °Brix. AMC-38 (5.84°Brix) had the highest TSS, followed by AMC-7 (5.51 °Brix). AMC-2 (0.89 %) had the highest titratable acidity of all the accessions, which was on par with AMC-19 (0.87 %) and AMC-36 (0.86 %). AMC-1 has the highest ascorbic acid content (290.53 mg/100 g) which was on par with AMC-4 (290.52 mg/100 g) and AMC-8 (287.15 mg/100 g). Based on the pooled performance of the top ten *Momordica cymbalaria* accessions identified for superior fruit quality were AMC-7, AMC-18, AMC- 4, AMC-1, AMC-32, AMC-27, AMC-6, AMC-9, AMC-22 and AMC-39. Genotypes with higher TSS, lower acidity and greater ascorbic acid concentration are considered ideal for enhancing the sensory appeal and nutritional value of fruits. Therefore, these accessions represent promising genetic resources for improving fruit quality in *M. cymbalaria* breeding programs.

Keywords **:** *Momordica cymbalaria*, Underutilised vegetable, Nutritive value, Human health.

Introduction

Momordica cymbalaria Hook. & Fenzl., also known as *Luffa tuberosa* or *Momordica tuberosa* (Roxb.), is a species in the Cucurbitaceae family native to tropical regions of India and Southeast Asia. This medicinal herb, commonly referred to as karchikai in Kannada, athalakkai in Tamil, or kasarakai in Telugu, is not typically cultivated as a regular crop by farmers. Instead, it emerges during the monsoon season, primarily in the black soils where crops such as sorghum, Bengal gram, and onion are grown, particularly in South Indian states such as Andhra Pradesh, Karnataka, Madhya Pradesh, Maharashtra, and Tamil Nadu. Although it thrives in both the *kharif* and *rabi* seasons, its cultivation has not been widespread. *Momordica cymbalaria* is gaining popularity as a vegetable due to its high nutritional value. However, limited awareness of its benefits has hindered its widespread cultivation and commercial availability.

Momordica cymbalaria is valued for its edible fruits and leaves, which are used as vegetables, and its tubers, which are primarily utilized for medicinal purposes. The nutritional profile of kasarakai includes

significant amounts of carbohydrates (3.72%), protein (3.26%), fat (1.61%), fibre (5.63%) and ash (1.25%) (Jeyadevi *et al.,* 2012). Various studies have shown that the fruit of *Momordica cymbalaria* possesses multiple medicinal properties. It has hypoglycemic, hypolipidemic, cardioprotective, hepatoprotective, nephroprotective and antidiarrheal properties. The presence of saponins is responsible for its hepatoprotective, antioxidant and anticancer effects as noted by Patel *et al.* (2014). Additionally, it has antimicrobial activity as documented by Jeevanantham *et al.* (2011). Not only the fruits but also the tubers and leaves of this plant are used for therapeutic purposes. These parts contain bioactive compounds such as flavonoids, steroids, triterpenes and saponins. Specifically, the tubers are known to contain sterols, triterpenes, cardiac glycosides and saponins as reported by Kaskurthy *et al.* (2015).

Underutilized vegetable crops are generally characterized by their limited commercial cultivation and restricted presence in formal trade channels. Despite their recognized nutritional and medicinal potential, these crops have not received adequate attention in research or extension programs. Lack of good-quality planting material, limited public awareness about their nutritional and medicinal benefits and the scarcity of clear, accessible information on how to grow them successfully are the main reasons for the crops to remain underutilized. Hence this study was carried out to evaluate the quality traits of *Momordica cymbalaria* accessions to identify the best genotyes to use in future breeding programs for nutritional improvement of the crop.

Material and Methods

The present investigation was carried out at the Vegetable Block, College of Horticulture, Anantharajupeta, Dr. Y.S.R. Horticultural University, Andhra Pradesh, during 2023-24 the performance of forty *Momordica cymbalaria* genotypes collected from different locations for various quality traits under field conditions. The experiment was laid out in a completely randomized design with two replications under open-field conditions during the *kharif* season. Polythene bags measuring 13 × 13 inches were filled with a potting mixture prepared by adding red soil, sand and farmyard manure in the ratio of 2:1:1. One tuber was planted per polybag at a depth of 2-3 cm, followed by light irrigation to prevent leaching during the early establishment period. Standard cultural and plant protection practices recommended for bitter gourd were uniformly followed to ensure healthy crop growth and development throughout the experimental period. The total soluble solids (TSS) of the fruits were determined using a hand refractometer (°Brix). Juice was extracted from fully ripe fruits, and a drop was placed on the refractometer prism for direct reading. The titratable acidity (%) was estimated by titrating the juice extracted from homogenized pulp against 0.1 N NaOH using phenolphthalein as an indicator. The results were expressed as a percentage of citric acid, following the procedure described by Ranganna (1977). The ascorbic acid content (mg/100 g) of the fruit pulp was estimated by titration using 2,6-dichlorophenolindophenol dye, as per the method standardized by the Association of Official Analytical Chemists (AOAC, 1990).

Results and Discussion

TSS

The TSS in fruits of 40 *Momordica cymbalaria* accessions ranged from 2.36 to 5.84°Brix, with twenty of them surpassing the overall average mean value of 3.95°Brix. Among the accessions, AMC-38 (5.84°Brix) had the highest TSS, followed by AMC-7 (5.51°Brix). Whereas, the genotype AMC- 19 (2.36°Brix) recorded the lowest TSS.

The total soluble solids (TSS) content reported in the present study for *M. cymbalaria* is consistent with the observations of Amarnath *et al*. (2024). Comparable TSS levels have also been reported in *M. charantia* by Srinivasulu *et al*. (2024), Sagar *et al*. (2024), Prakash *et al.* (2021), and Singh *et al*. (2023). Similar findings were noted in *M. cochinchinensis* by Rahman *et al*. (2024) and in *M. subangulata* ssp. *renigera* by Naik *et al*. (2014) (Fig. 1).

Titratable Acidity (%)

Fruits from 40 *Momordica cymbalaria* accessions had titratable acidity ranging from 0.27 to 0.89 %, with 19 exceeding the average of 0.61 %. The accession AMC-2 (0.89%) had the highest titratable acidity of all the accessions, on par with AMC-19 (0.87%) and AMC-36 (0.86%). However, the genotype with the lowest titratable acidity was AMC-7 (0.27%).

Titratable acidity contributes to flavour balance, microbial stability and processing characteristics. Genotypes differ in organic acid synthesis (malate and citrate metabolism) as fruits ripen, acids are metabolized, so the maturity stage is a primary driver of TA differences among accessions. A moderate titratable acidity with a balanced TSS: TA ratio is usually most desirable. Similar findings were reported by Sagar *et al.* (2024) and Prakash *et al.* (2021) in *M. charantia* (Fig. 2).

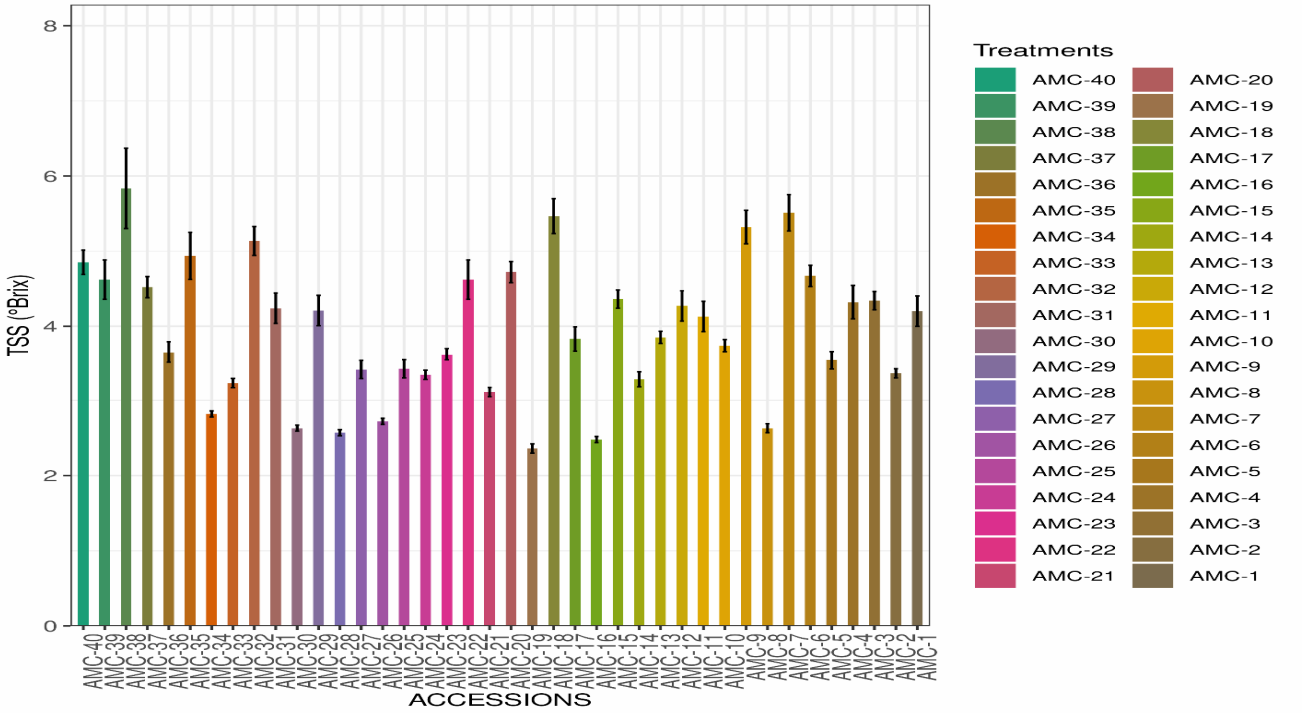

Fig. 1 : Variation in TSS among forty *Momordica cymbalaria* accessions

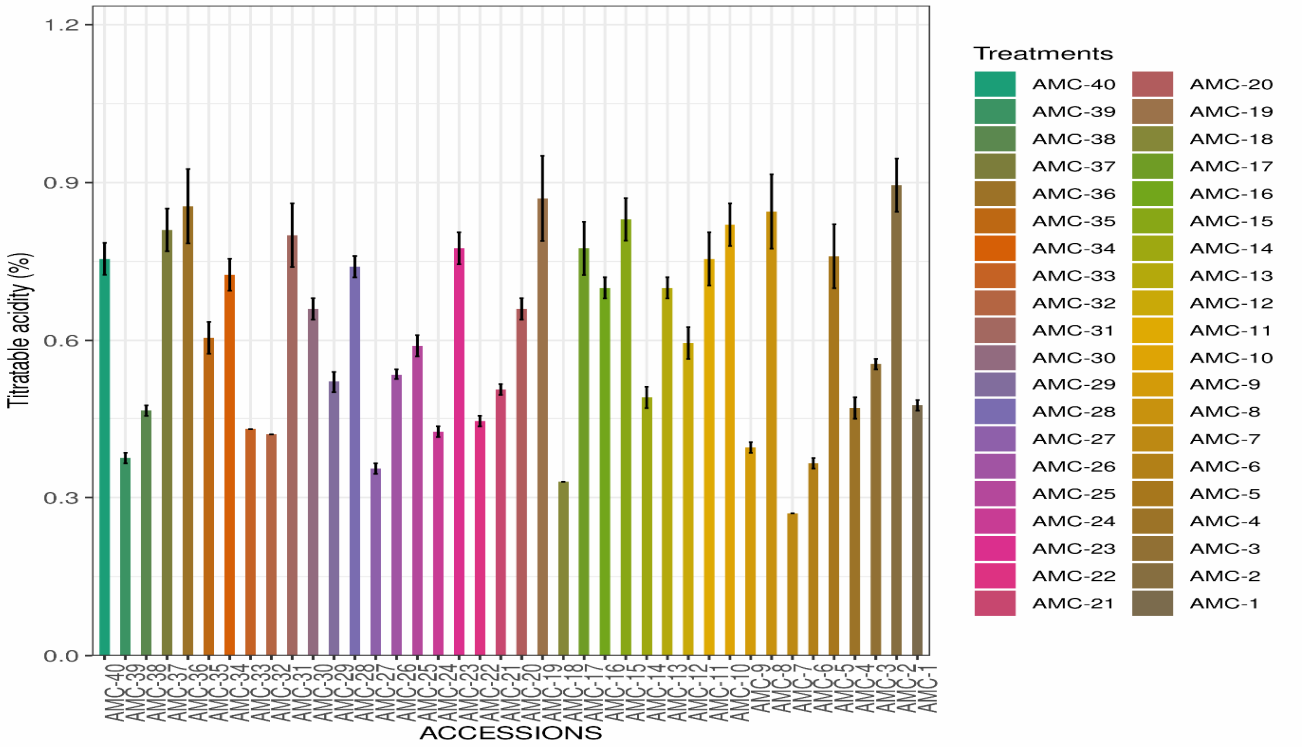

Fig. 2 : Variation in Titratable Acidity among forty *Momordica cymbalaria* accessions

Ascorbic Acid (mg/100g)

Ascorbic acid concentrations in 40 *Momordica cymbalaria* accessions ranged from 276.48 to 290.53 mg/100 g. Out of all the accessions, AMC-1 has the highest ascorbic acid content (290.53 mg/100 g), which was on par with AMC-4 (290.52 mg/100 g), AMC-8 (287.15 mg/100 g), AMC-16 (288.82 mg/100 g), AMC-17 (289.20 mg/100 g), AMC-25 (288.91 mg/100 g), AMC-27 (288.46 mg/100 g), AMC-33 (287.16 mg/100 g), AMC-34 (289.42 mg/100 g). However, AMC-38 contains the lowest ascorbic acid content of (276.48 mg/100g).

Vitamin C is a water-soluble vitamin required for the biosynthesis of collagen and certain neurotransmitters and involved in protein metabolism Li and Schellhorn (2007). The present findings for ascorbic acid content are in accordance with the observations of Parvathi and Kumar (2002), Amarnath *et al*. (2024), Chinthan *et al*. (2021) and Rajamanickam and Arunachalam (2024) in *Momordica cymbalaria*. Similar results were also reported in *M. dioica* by Chunduri (2013) and Sagar and Singh (2022). Comparable trends were observed in *M. charantia* by Sagar *et al*. (2024), Krishnendu and Nandini (2016), Prakash *et al*. (2021), Nguyen *et al*. (2020), Singh *et al*. (2023), Kishorkumar *et al*. (2023) and Paul *et al*. (2022) (Fig. 3).

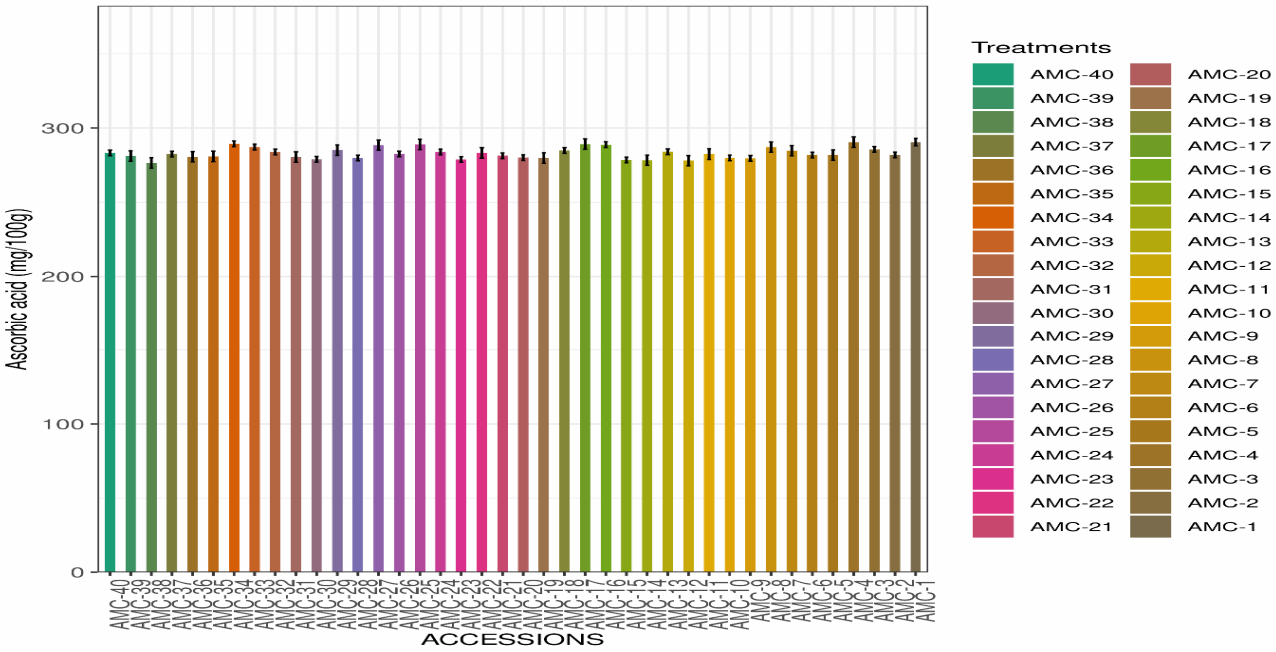

Fig. 3 : Variation in Ascorbic acid among forty *Momordica cymbalaria* accessions

The biochemical quality traits, including total soluble solids (TSS), titratable acidity, and ascorbic acid, were evaluated for forty *Momordica cymbalaria* genotypes and each parameter was standardized through normalization to eliminate unit disparities. Since higher TSS and ascorbic acid values are desirable while lower titratable acidity indicates better fruit quality, the acidity values were inversely normalized. A composite quality score was then calculated as the mean of the normalized values of these three parameters for each genotype. The top ten genotypes were identified based on their composite quality scores, which represent an overall measure of fruit biochemical superiority was presented in (Figure 4.).

Based on the pooled performance of total soluble solids, titratable acidity and ascorbic acid content, the top ten *Momordica cymbalaria* accessions identified for superior fruit quality were AMC-7, AMC-18, AMC-4, AMC-1, AMC-32, AMC-27, AMC-6, AMC-9, AMC-22, and AMC-39. AMC-7 registered the highest composite quality score due to its markedly high TSS (5.51 °Brix), very low titratable acidity (0.27%) and favourable ascorbic acid levels. AMC-18 also performed exceptionally well, supported by elevated TSS (5.46 °Brix) and moderate acidity, contributing to enhanced sweetness and flavour balance. AMC-4 and AMC-1 combined moderate TSS values with comparatively high ascorbic acid concentrations, reflecting stronger nutritional quality. Accessions AMC-32 and AMC-27 showed balanced biochemical contributions across all parameters, indicating consistently favourable fruit composition. Similarly, AMC-6, AMC-9, AMC-22 and AMC-39 exhibited proportionately advantageous combinations of higher ascorbic acid and reduced acidity, allowing them to achieve competitive composite scores despite moderate TSS ranges. Genotypes expressing higher TSS, lower acidity and greater ascorbic acid content are regarded as ideal candidates for improving both sensory attributes and nutritional value. Therefore, these ten accessions represent promising genetic resources for enhancing fruit quality in *M. cymbalaria* breeding programmes.

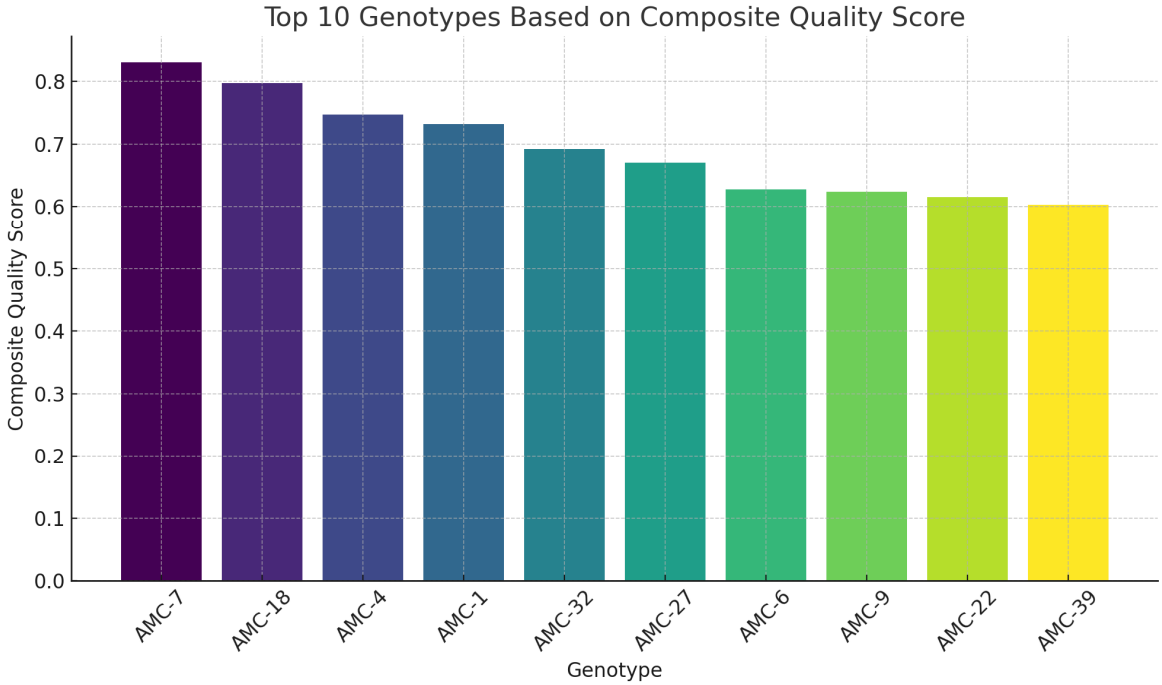

Fig. 4 : Top ten *Momordica cymbalaria* genotypes based on composite quality score (TSS, titratable acidity, and ascorbic acid). Higher composite values indicate superior overall fruit quality.

Conclusion

In cucurbitaceous crops such as *Momordica cymbalaria*, fruit quality is primarily determined by the balance between sweetness, acidity, and nutritional composition. A higher total soluble solids content indicates superior sweetness and a more robust flavour profile, which are essential for consumer preference and market acceptability. Conversely, a lower titratable acidity value is desirable, as it contributes to a milder taste and better sugar–acid balance, improving the overall palatability of the fruits. Additionally, ascorbic acid is an essential antioxidant that enhances the nutritional value and post-harvest quality of the fruits. Genotypes combining high TSS, low acidity, and elevated ascorbic acid content, such as AMC-7, AMC-18, AMC-4, AMC-1 and AMC-32 are therefore considered superior for breeding programs aimed at improving fruit quality. These parameters collectively influence both organoleptic appeal and nutritional efficiency, making them reliable indicators of quality improvement in *M. cymbalaria* and related cucurbit species. Chemical analysis alone, however, should not be the exclusive criterion for judging the nutritional quality of plant parts. Thus, it becomes necessary to consider other aspects, such as the presence of anti-nutritional/toxicological factors and the biological evaluation of nutrient contents

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