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Biochemical Characteristics of Bitter Gourd (*Momordica charantia* L.) in Southern India

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Abstract

In this present investigation, F_4 progenies of three cross combinations of bitter gourd namely, $P_1 \times P_4$ (MC105 × Pant karela-2), $P_2 \times P_4$ (TCR471 × Pant karela-2), $P_3 \times P_6$ (BBGS-09-1 × Arka Harit) and their respective parents P_1 (MC105), P_2 (TCR471), P_3 (BBGS-09-1), P_4 (Pant karela-2), and P_5 (Arka Harit) were used to analyze the biochemical properties such as total soluble solids, protein content, ascorbic acid content, iron content, momordicine content and total chlorophyll content. The experiment with three cross combination was laid out in a randomized block design. The experiment revealed that the TSS was maximum in progeny $P_2 \times P_4$ (2.52 °brix) while it was minimum in $P_1 \times P_4$ (2.38 °brix). The maximum protein content (1.78%) was recorded in $P_2 \times P_4$ while it was minimum (1.70%) in $P_1 \times P_4$. The maximum ascorbic acid content (103.50 mg-100 g^{-1}), iron content (2 mg/kg^{-1}), momordicine content (1.98 mg-g^{-1}) and total chlorophyll content (0.43 mg-100 g^{-1}) was recorded in progeny $P_1 \times P_4$.

1. Introduction

Bitter gourd (*Momordica charantia* L.) is an economically important member of the Cucurbitaceous family that is widely cultivated in India, China, Malaysia, Africa, and South America (Raj *et al.*, 1993; Singh, 1990). Bitter gourd is known by various names, as balsam pear, bitter melon, bitter cucumber, and African cucumber (Heiser, 1979). In India, the major growing states are Karnataka, Maharashtra, Tamil Nadu and Kerala (Laxuman *et al.,* 2012). Bitter gourd originated in Indo-Malayan region but has acclimatized widely in the Old and New World (Bates *et al.*, 1995). In India the area under bitter gourd is 97,000 hectares with a production of 11, 37,000 MT NHB (2018). It is grown up to an elevation of 1600-1700 meter above mean sea level. Optimum temperature requirement for the crop is 24-27 °C (Salunkhe and Kadam, 2005).

It is a fast growing warm seasonal climbing annual. The herbaceous tendril bearing vine grows up to 5 m height. It bears simple, alternate leaves, 4-12 cm across, with 3-7 deeply seperated lobes and each plant bears separate male and female flowers (Islam *et al.*, 2009). Bitter gourd contains a reasonable amount of different nutrients such as proteins, carbohydrates, fats, minerals and vitamins A, B_2, and C *etc*. Raja *et al.* (2007) reported very high amount of vitamin C (95 mg-100 g^{-1}) and protein (930 mg-100 g^{-1}) in some Indian bitter gourd varieties. Fruits of bitter gourd are widely consumed as a vegetable and are well known for its anti-diabetic and other medicinal properties (Robinson and Decker-Walters, 1997). Bittergourd fruit are rich in Vitamin A, C, Iron, Phosphorous and Carbohydrates (Miniraj *et al.,* 1993; Desai *et al.,* 1998) which helps in improving body immunity against infection (Belonin *et al.,* 2005).

Fruit also contains two alkaloids *viz.,* momordicin and cucurbitacin, momordicin is the momordicosides glycosides of tetracyclic triterpinoides with cucurbitane (Chandravadana and Chander, 1990). Bitter gourd is usually grown in kitchen garden as a summer vegetable. But at present it is also being grown as commercial crop near the urban areas. Although the bitterness of bitter gourd might turn some people away, it really sweetens the diet because of its disease preventing and health promoting phytochemical compounds.

2. Materials and Methods

The experimental materials comprised of three F_4 progenies & parents were raised with an inter row spacing of 2 m and intra row spacing of 1.5 m. The study was conducted in the Western block, Department of Vegetable crops, Horticultural College and Research Institute, Periyakulam, Tamil Nadu Agricultural University (TNAU), during August 2017 - June 2018. The experiment was laid out in a Randomized Block Design with three replications. Data were recorded on TSS content, Ascorbic acid content, Protein content, Iron content, Momordicine content and Total chlorophyll content. Protein

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content in fruit was estimated following the method of Lowry *et al.* (1951). Ascorbic acid content of tender bitter gourd pulp was estimated as per the procedure described in A.O.A.C. (1975) and expressed in mg-100 g^{-1} of fresh sample. The iron content was estimated following the method suggested by Lindsay and Norvell (1988). The bitter principle (momordicine) of fruit was estimated by analysing the total triterpene content on dry weight basis as suggested by Chandravadana and Chander (1990). The data were analyzed by using GENRES statistical software programme.

3. Results and Discussion

In F_4 generation, total soluble solids ranged from 2.38 °brix ($P_1 \times P_{4)}$ to 2.52 °brix ($P_2 \times P_{4)}$ with the general mean of 2.44 °brix. The progeny $P_2 \times P_4$ was recorded maximum TSS (2.52 °brix) compared to the mean value 2.44 °brix. Similar result was observed by Bahari *et al.,* (2012) in watermelon. The protein content ranged from 1.70% ($P_1 \times P_4$) to 1.78% ($P_2 \times P_{4)}$ with mean of 1.73%. The progeny $P_2 \times P_4$ recorded the maximum protein content (1.78%) compared to the mean value of 1.73%. These results are in accordance with Kshirsagar (2009) and Choudhary *et al.,* (2014). Ascorbic acid content ranged from 82.60 mg-100 g^{-1} ($P_3 \times P_5$) to 103.50 mg-100 g^{-1} ($P_1 \times P_4$) with mean of 94.33 mg-100 g^{-1}. The progeny $P_1 \times P_4$ was recorded the maximum Ascorbic acid content (103.50 mg-100 g^{-1}) while it was minimum (82.60 mg-100 g^{-1}) in $P_3 \times P_5$. Similar result was recorded by Thangamani *et al.,* (2011) in bitter gourd.

The iron content ranged from 1.37 mg-kg^{-1} ($P_3 \times P_5$) to 2.00 mg-kg^{-1} ($P_1 \times P_{4)}$ with mean of 1.72 mg-kg^{-1}. The maximum iron content (2.00 mg-kg^{-1}) was noticed in progeny $P_1 \times P_4$ while it was minimum (1.37 mg-kg^{-1}) in $P_3 \times P_5$. Arunkumar *et al.,* (2011) also reported the wide range of variability in iron content of cucumber which is in line with the results of present study. The momordicine content ranged from 1.48 mg-g^{-1} ($P_3 \times P_5$) to 1.98 mg-g^{-1} ($P_1 \times P_4$) with mean of 1.78 mg-g^{-1}. The maximum momordicine content (1.98 mg-g^{-1}) was recorded in progeny $P_1 \times P_4$ while it was minimum (1.87 mg-g^{-1}) in $P_2 \times P_4$. These results are in agreement with the results of Bahari *et al.,* (2012) in water melon. Total chlorophyll content ranged from 0.32 mg-100 g^{-1} ($P_3 \times P_5$) to 0.43 mg-100 g^{-1} ($P_1 \times P_4$) with mean of 0.36 mg-100 g^{-1}. The maximum total chlorophyll content (0.43 mg-100 g^{-1}) was recorded in progeny $P_1 \times P_4$ while it was minimum (0.32 mg-100 g^{-1}) in $P_3 \times P_5$ which is represented in Table 1. Reddy *et al.* (2013) also reported the variability pattern in total chlorophyll content of ridge gourd which is in accordance with the results of present study.

Table 1: Per se performance of progenies for different biochemical traits of bitter gourd in F4 generation

Progenies	TSS (°Brix)	Proteincontent (%)	Ascorbicacid (mg-100 g^{-1})	Iron content (mg kg^{-1})	Total chlorophyll cotent (mg-100 g^{-1})	Momordicine (mg g^{-1})
P1 × P4	2.38	1.70	103.50*	2.00*	0.43*	1.98*
P2 × P4	2.52	1.78	96.90	1.78	0.33	1.87*
P3 × P5	2.43	1.72	82.60*	1.37*	0.32*	1.48*
MEAN	2.44	1.73	94.33	1.72	0.36	1.78
SE.d	0.054	0.027	2.452	0.043	0.005	0.027
CD (0.05)	0.122	0.054	5.906	0.093	0.03	0.068

*Significant at 5% level

4. Conclusion

Based on the above experimental data the progeny $P_1 \times P_4$ was considered as best one because, it exhibits the superior performance in protein content, iron content, ascorbic acid content, momordicine content and total chlorophyll content. It is thus concluded that the cross combination $P_1 \times P_4$ (MC105 × Pant karela-2) were the best one among the studied progeny based on their quality attributes.

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