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Variation in Leaf Biochemical Compositon of Guava (*Psidium guajava* L) Hybrids

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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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Short Research Article

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ABSTRACT

Interplay of several internal development cues leads to floral induction in perennials like guava, mango and litchi. The transition of plants from the vegetative to the reproductive phase depends on the biochemical composition of the leaves. In view of this, the present study was conducted to know the variation in biochemical composition in non-flowering and flowering guava plants. Seven guava hybrids H1 (ARP selection x Lalit), H2 (Lalit x ARP selection), H3 (Allahabad Safeda x ARP selection), H4 (Lalit x Allahabad Safeda), H5 (Allahabad Safeda x Lalit), H6 (Nagpur Seedless x Allahabad Safeda) and OP (Open pollinated progeny of Allahabad Safeda).) were used for estimation of biochemical constituents in blooming and non-blooming plants. Results revealed that higher levels of total sugars, protein, and carbohydrates were observed in the leaves of non-blooming plants compared to blooming plants. However, compared to non-flowered plants, flowering plants had leaves with a higher amount of total phenol.

Keywords: Guava; carbohydrates; proteins; phenols; total sugars.

1. INTRODUCTION

Psidium guajava L. (2n=22, family Myrtaceae) is grown around the world in tropical and subtropical climates. Guava is a member of the Myrtaceae family, which has around 5650 species and 150 genera [1]. Guava is grown over 292 thousand hectares in India, with a production of 4361 thousand metric tonnes [2]. Major guava producing states are Maharashtra, Bihar, Uttar Pradesh, Gujarat, Madhya Pradesh, Odisha, Andhra Pradesh and Punjab. Guava is grown over an area of 9.53 thousand hectares with an annual production of 229.78 thousand metric tonnes in Andhra Pradesh [3]. Vitamin A, thiamin, riboflavin and ascorbic acid content are abundant in edible guava fruits. The leaves of the guava plant are used to cure diabetes, diarrhea, cancer, neurodegenerative, gastrointestinal, and cardiovascular diseases, whereas dried and ripened fruits are considered the best remedy for dysentery [4,5,6,7,8].

Flowering plays an essential role for successful consecutive production of fruit crops. Understanding the role of biochemical constituents like carbohydrates, proteins, total sugars, and total phenols regarding flower initiation is an important aspect during the initial stage of hybrid evaluation. Plants produced phenolic compounds as secondary metabolites through the metabolism of phenylpropanoid in the pentose phosphate and shikimic acid pathways. Higher amount of carbohydrates was consumed during the beginning and subsequent development of floral organs [9]. Stimulation of carbohydrate catabolism in pear bud might occur due to lower levels of sugars. Based on the importance of different biochemical constituents during flower initiation, a study was conducted to know the role of carbohydrates, proteins, total sugars, and total phenols in the flowering of guava hybrids.

2. MATERIALS AND METHODS

An experiment was carried out on three-year-old hybrids of guava at the College of Horticulture, Dr. Y. S. R. Horticultural University, Anantharajupeta, Andhra Pradesh. Hybrids include H1 (ARP selection x Lalit), H2 (Lalit x ARP selection), H3 (Allahabad Safeda x ARP selection), H4 (Lalit x Allahabad Safeda), H5 (Allahabad Safeda x Lalit), H6 (Nagpur Seedless x Allahabad Safeda), and OP (Open pollinated progeny of Allahabad Safeda). A randomized block design was used for the current investigation, with three replications for each treatment. To establish the relationship between leaf biochemical constituents and flowering, leaf samples were collected from flowering and non-flowering hybrids for estimation of carbohydrates, protein, total sugars, and total phenols. Total sugars in leaves were determined by Yemm and Willis [10]. Total phenols from guava leaves were extracted by procedure developed by Singleton et al. [11]. Based on Lowrys [12] method, Protein content was estimated. Total carbohydrates were estimated based on the Anthrone method [13]. The collected data was statistically analyzed by using an analysis of variance (ANOVA) test. All these analyses were processed by using OPSTAT.

3. RESULTS AND DISCUSSION

The overall levels of total sugars, total proteins, total carbohydrates and total phenol varied greatly between blooming and non-blooming hybrid guava plants. The content of biochemical components in the leaves of guava hybrid plants is displayed in Table 1. The total sugar content of non-flowering hybrid leaves ranged from 1.38 to 1.79 mg/g and in blooming hybrid plants, it ranged from 0.77 to 1.58 mg/g. In comparison to flowering hybrids higher total sugars were found in leaves of non-flowering hybrids. Within non-flowering hybrids, the highest total sugar content was observed in H2, H6 and the lowest in H4. Regardless of hybrids, flowering plants showed a lower amount of total sugar compared to non-flowering plants. Cho et al. [14] and Moghaddam and Ende [15] mentioned the role of sucrose in relation to flowering. In vegetative tissues, sugars trigger the proliferation of vegetative organs and produce larger and thicker leaves (19). Sugars produced in mango leaves are a potential driving force for phloem-based transport of a flowering promoter (20). Carbohydrate content in the leaves of non-flowering hybrids ranged from 0.57-1.14 mg/g, whereas it ranged from 0.35-0.71 mg/g in flowering plants. Among non-flowering hybrids, maximum carbohydrates were recorded in H1 and a minimum in H2. During flower-bud differentiation process carbohydrate content of leaves, roots and shoot tips might play an essential role [16]. Adequate amount of carbohydrates is utilized for the initiation and development of floral organs in meristematic region of pear [17]. Regarding protein content in leaves, it varied from 1.42-3.86 mg/g where flowering plants registered a range of 1.26-3.22 mg/g. Among non-flowering hybrids, maximum protein content was observed in H1 and H6. As compared to flowering plants, non-flowering plants showed lower amount of leaf protein content. During flower initiation process genes related to autophagy and degradation of protein content are involved [18].

Leaves of flowering hybrids showed a higher content of total phenols compared to non-flowering ones. It ranged from 5.36-7.43 mg/g in non-flowering plants and 6.52–9.49 mg/g in flowering plants. There was no significant difference among hybrids in non-flowering plants. The highest total phenol content in leaves was observed in OP and the lowest in H2. The mobilization of stored food supplies to shoots, which encourages floral bud differentiation and resulting in flowering. The hormone that causes floral initiation and development in litchi is analogized by phenols [19]. In Mango cv Neelum, the highest level of total phenol content was recorded at flower and fruit bud differentiation [20] which provide supporting evidence on the role of phenol in guava flowering. Phenolic content of fruit buds in mango was stable in undifferentiated (or) scar buds while it increased steadily with advancing flower bud differentiation [21-23].

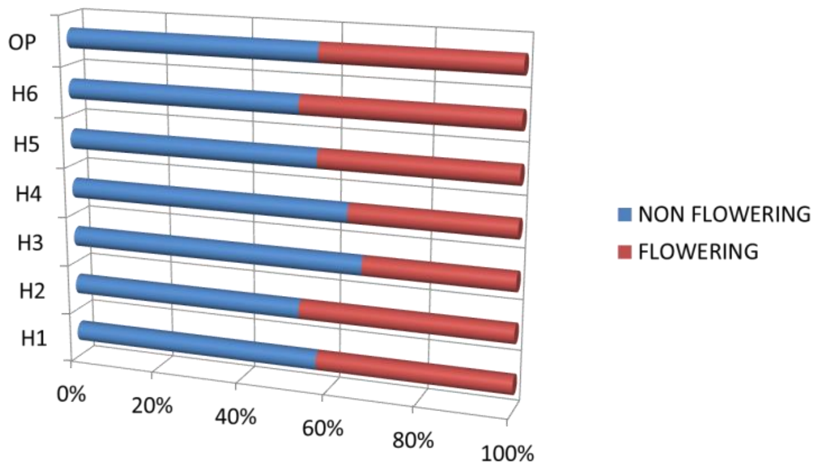

Fig. 1. Difference of leaf total sugars content in non-flowering over flowering in guava hybrids

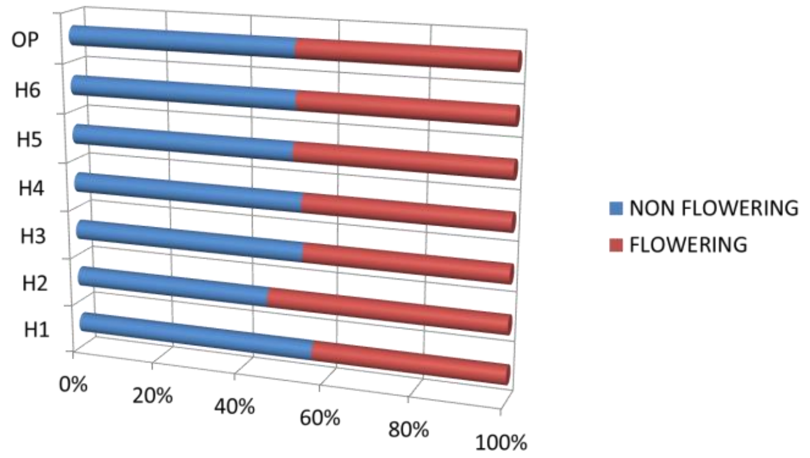

Fig. 2. Difference of leaf protein content in non-flowering over flowering in guava hybrids

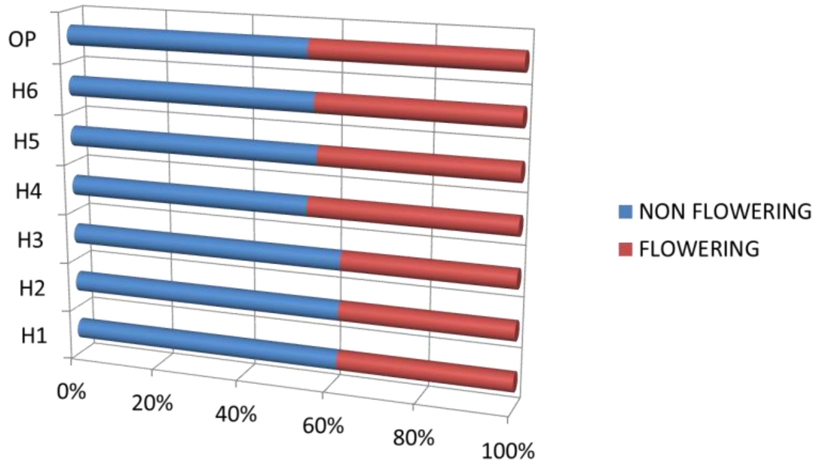

Fig. 3. Difference of total carbohydrates content in non-flowering over flowering in guava hybrids

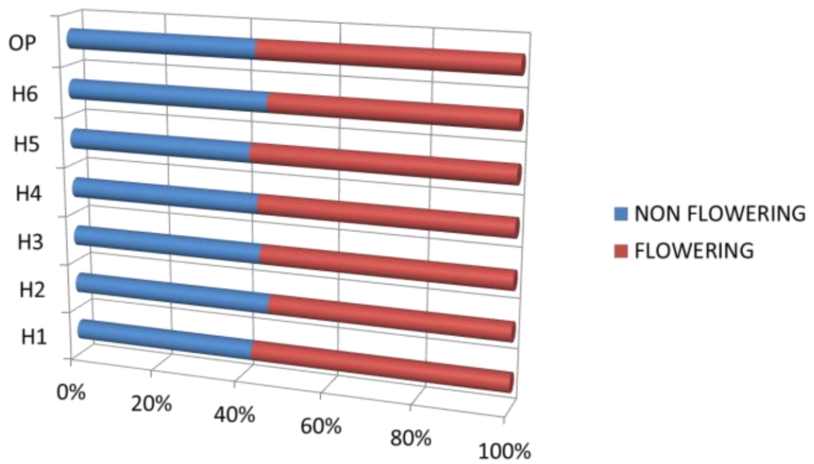

Fig. 4. Difference of leaf total phenols content in non-flowering over flowering in guava hybrids

Table 1. Total sugars, carbohydrates, proteins and total phenols in flowering and non-flowering guava hybrids

Hybrids	Total sugars (%)		Protein content (mg/g)		Total carbohydrates (mg/g)		Total phenols (mg/g)	
	Non flowering	Flowering	Non flowering	Flowering	Non flowering	Flowering	Non flowering	Flowering
H1	1.58	1.19	4.06	3.10	1.14	0.71	6.28	8.50
H2	1.79	1.58	2.03	2.35	0.57	0.35	5.66	6.52
H3	1.57	0.77	3.86	3.22	0.71	0.43	7.37	9.14
H4	1.38	0.78	3.56	3.00	0.79	0.65	5.36	6.82
H5	1.60	1.20	2.60	2.37	0.73	0.55	6.28	8.52
H6	1.79	1.58	1.42	1.26	0.79	0.61	5.70	6.57
OP	1.60	1.19	2.52	2.25	0.82	0.67	7.43	9.49
C.D.	0.04	0.04	0.20	0.76	0.05	0.11	NS	1.78

4. CONCLUSION

Assessment of biochemical parameters in the leaves of flowering and non-flowering hybrids revealed that flowering plants registered the highest phenol levels, while non-flowering plants registered high total sugars, carbohydrates, and proteins. Phenols as a secondary metabolite play a major role in plant defence mechanisms and, at higher concentrations, favour flower initiation and prevent flower drop by reducing oxidative stress. Thus, understanding the floral mechanism of guava plants and effectively planning crop improvement programmes is aided by knowledge of leaf biochemical composition in flowering and non-flowering hybrids.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares 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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