



Annual Research & Review in Biology

Volume 39, Issue 3, Page 29-33, 2024; Article no.ARRB.113585

ISSN: 2347-565X, NLM ID: 101632869

(Past name: Annual Review & Research in Biology, Past ISSN: 2231-4776)

Study on Rachis Characters of Different Cultivars of Banana

**Mihir Karmakar ^a, Tanmoy Mondal ^{a*}, Rajdeep Mohanta ^b,
Gouri Mandi ^a, Subrata Mahato ^a and Fatik Kumar Bauri ^a**

^a Department of Fruit Science, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, 741252, India.

^b Department of Agriculture, Brainware University, Barasat, Kolkata 700125, West Bengal, India.

Authors' contributions

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

Article Information

DOI: 10.9734/ARRB/2024/v39i32063

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/113585>

Original Research Article

Received: 14/12/2023

Accepted: 22/02/2024

Published: 29/02/2024

ABSTRACT

Banana is one of the most important staple food around tropics. Bananas can be eaten as green when it is starchy. These crops are the most important components for food security around world by providing income to the farming community through local trade. This experiment was conducted to study the rachis behaviour and male bud characteristics of ABB genomic group and AAB genomic group banana cultivars. Here 5 cultivars under ABB genomic group (Behula, Bara Beglo, Bluggoe, Green Bombay, Pantharaj) and 5 cultivars of AAB genomic group (Dudhsagar, Martaman, Manohar, Desi Malbhog, Kalibhog) were observed. All of these 10 cultivars showed different characteristics in case of male bud, like male bud shape, male bud size, colour of the bract (external face), male bract lifting, wax on the bract, male flower behaviour, compound tepal basic colour, anther colour, stigma colour, ovary shape and dominant colour of male flower, all these were explained in details in this study.

Keywords: *Banana; rachis; male bud; genomic group; Musa acuminata; genomic group.*

*Corresponding author: E-mail: tanmoymondalbckv@gmail.com;

Ann. Res. Rev. Biol., vol. 39, no. 3, pp. 29-33, 2024

1. INTRODUCTION

“Banana (*Musa spp.* L) is an antique fruit grown in the world. It is the 4th most important crop after rice, wheat and corn in the world” [1]. “It belongs to Musaceae family and edible banana native to South East Asia. It is possibly the world's oldest cultivated crop” [2]. “It is divided into edible cultivars and non-edible wild species. The edible bananas include dessert, cooking and beer making cultivars, which mostly originated from Southeast Asia” [3]. “Their ancestors are *Musa acuminata* Colla denoted as AA and *Musa balbisiana* Colla (BB). The natural hybridization between and within *M. acuminata* and *M. balbisiana* resulted in several cultivars with different genomes and ploidy levels” [4]. “The possible genomic groups for bananas include; AA, BB, AB, AAA, AAB, ABB AABB, AAAB and ABBB” [5]. “Among AAB triploids, there are 11 subgroups” as reported by Uma et.al, [6]. Many banana cultivars with ABB genomes, such as ‘Kluai Tip Yai’, ‘Kluai Hak Muk’, and ‘Kluai Nam Wa,’ are grown in Thailand [7]. “The edible bananas are indigenous to Asia, which is the fourth most important commodity in the world after rice, wheat and corn. Banana are one of the most important commercial food crops, especially in the tropics. It is a monocotyledonous, perennial, herbaceous succulent plant and one of the world's important fruit crops. It comes under the order Zingiberales and botanically named as *Musa paradisiaca*. It also rich in Carbohydrate (21.8gm/100g), Protein (1.1gm/100gm), Potassium (385 mg/100gm), β -carotene (68 μ g), Niacin (610 μ g), Vit-C(11.7mg/100gm) and Water (74 gm)” (Aurore et al. 2009). “Banana contains 20% sugars. Bananas are nutritionally low protein food material but relatively high in carbohydrates, vitamins and minerals” [8]. Recently banana flower is an important agricultural by-product that is often consumed as vegetable in many Asian countries such Malaysia, Indonesia, Sri Lanka, Philippines and other South East Asia countries and rich source of different minerals and nutrients.

Thus acquiring knowledge on rachis of bananas can provide additional benefits on characterization and increasing its use. The present study aimed to characterize the different genomic groups of banana.

2. MATERIALS AND METHODS

The present experiment was carried out at ICAR-AICRP on Fruits, Mohanpur Centre, Bidhan

Chandra Krishi Viswavidyalaya, Mondouri, Nadia, West Bengal during the period of 2019-2021. The experimental site was situated at 23.50° North latitude and 89° East longitude with an altitude of 9.75 meter above the mean sea level. Ten cultivars were planted in a spacing of 2.5m \times 2m, taken for present investigation and these were Behula (ABB), Bara Beglo (ABB), Bluggoe (ABB), Green Bombay (ABB), Pantharaj (ABB), Dudhsagar (AAB), Martaman (AAB), Manohar (AAB), Desi Malbhog (AAB) and Kalibhog (AAB). The rachis and male bud parameter were taken by daily visual observation. Rachis and male bud parameters of twelve characters were selected for characterization of rachis and male bud of different cultivars of bananas by using NBPGR descriptor.

3. RESULTS AND DISCUSSION

Table 1 present the rachis and male bud parameters of different cultivar under the ABB genomic group. The number of scars on rachis varied from 60 for Green Bombay to 34 for Bluggoe. The shape of male bud of all cultivar were ovoid. The length of male bud was varied from 21-30 cm for all cultivar. Red-purple colour of the external face of bracts were found in Behula, Bara Beglo, Bluggoe and Pantharaj, whereas in case of Green Bombay was purple colour. Male bract was lifting one time for Behula and Green Bombay, where two time for Bluggoe, Pantharaj and Bara Beglo. Most of the cultivar of ABB genomic group were very wax bract except Pantharaj which was moderate waxy bract. The male flower behaviour of ABB genomic group were falling before bract. The compound tepal basic colour of all cultivar was cream except Behula which has white colour. Anther colour was not varied among the cultivars, all were found yellow. The stigma colour was cream for Behula, Bluggoe, Pantharaj, and Green Bombay, whereas pink-purple for Bara Beglo. The ovary shape was straight in Pantharaj, but arched in Behula, Bluggoe, Bara Beglo and Green Bombay. The dominant colour of male flower was pink in Behula, Bluggoe, Bara Beglo and Green Bombay but purple-brown in Pantharaj.

In this experiment, it was found that in Mali-Ong (ABB) the shape of male bud was ovoid. The male flower was yellow-orange colour. The male bud length at harvest is 27–29 cm. Bract base shape: tiny shoulder, obtuse apex, dark red exterior face, dark red interior face, deep grooves, and a waxy texture. Before falling, the

bract rolls and creates very prominent scars on the rachis. Male flowers fall after the bracts. Free tepal was oval in shape, translucent white, obtuse, and has a developed apex. There are five anthers, which are yellow with red at the lobe margin, anther exertion is at the same level, and the filament was yellow-green. The ovary shape was curved, the basic color was yellow, the style was straight, and the stigma was yellow. The arrangement of the ovules was four-rowed [9].

Table 2 present the rachis and male bud parameters of different cultivar under the AAB genomic group. The result showed that scars on rachis was varied from 33 (Manohar) to 47

(Desi Malbhog). The male bud shape was ovoid (Dudhsagar and Desi Malbhog), like a top (Manohar and Kalibhog) and intermediate (Martaman). The male bud size varied from 15 cm (Manohar) to 26 cm (Dudhsagar). Generally, the AAB Apple banana groups have a bare rachis at the time of fruit maturity, the Sukari Ndizi rachis is always bare, even just a few weeks after flowering [10]. The bract colour of external face was purple in Dudhsagar, Martaman, Manohar, Desi Malbhog and Kalibhog. In AAB genomic group male phase was short with whip like rachis ending with a 'top' shaped male bud [11]. In Dudhsagar, male bract lifting was one at a time and two at time lifting

Table 1. Rachis and male bud parameters of ABB

	Behula (ABB)	Bara Beglo (ABB)	Bluggoe (ABB)	Green Bombay (ABB)	Pantharaj (ABB)
Scars on rachis number	35	35	34	60	37
Male bud shape	Ovoid	Ovoid	Ovoid	Ovoid	Ovoid
Male bud size	21-30 cm	21-30(29) cm	21-30 cm	21-30(29) cm	21-30 cm
Colour of the bract (external face)	Red-purple	Red-Purple	Red-purple	Purple	Red-purple
Male bract lifting	One at a time	Lifting two or more at a time	Two at a time	Lifting one at a time	Two at a time
Wax on the bract	Very waxy	Very waxy	Very waxy	Very waxy	Moderate waxy
Male flower behavior	Falling before bract	Falling before the bract	Falling before bract	Falling before bract	Falling before bract
Compound tepal basic colour	White	Cream	Cream	Cream	Cream
Anther colour	Yellow	Yellow	Yellow	Yellow	Yellow
Stigma colour	Cream	Pink-purple	Cream	Cream	Cream
Ovary shape	Arched	Arched	Arched	Arched	Straight
Dominant colour of male flower	Pink	Pink	Pink	Pink	Purple-brown

Table 2. Rachis and male bud parameters of AAB

	Dudhsagar (AAB)	Martaman (AAB)	Manohar (AAB)	Desi Malbhog (AAB)	Kalibhog (AAB)
Scars on rachis number	42	42	33	47	39
Male bud shape	Ovoid	Intermediate	Like a top	Ovoid	Like a top
Male bud size	26 cm	24cm	15 cm	23 cm	24 cm
Colour of the bract (external face)	Purple	Purple	Purple	Purple	Purple
Male bract lifting	One at a time	Two at a time	Two at a time	Two at a time	Two at a time
Wax on the bract	Very waxy	Moderate wax	Very waxy	Moderate wax	Very waxy
Male flower behavior	Persistent	Falling before bract	Falling before bract	Falling before bract	Falling before bract
Compound tepal basic colour	Cream	Cream	Cream	Cream	Cream
Anther colour	Cream	Cream	Cream	Cream	Cream
Stigma colour	Yellow	Black	Cream	Black	Black
Ovary shape	Arched	Arched	Arched	Arched	Arched
Dominant colour of male flower	Cream	Cream	Purple brown	Cream	Purple brown



Fig. 1.
Bloggue



Fig. 2. Bara
beglo



Fig. 3.
Pantharaj



Fig. 4.
Kalibhog



Fig. 5.
Manohar



Fig. 6. Green
bombay



Fig. 7.
Martaman



Fig. 8.
Bloggue



Fig. 9. Bara
beglo



Fig. 10. Dudh
sagar



Fig. 11. Experimental field view

in Martaman, Manohar, Desi Malbhog and Kalibhog. Very waxy on the bract was present in Dudhsagar, Kalibhog and Manohar whereas, moderate wax on the bract was present in Martaman and Desi Malbhog. The male flower behavior was persistent (Dudhsagar) and falling before bract (Martaman, Manohar, Desi Malbhog and Kalibhog). All cultivar of AAB genome were cream colour compound tepal and anther, and ovary shape was arched. Stigma colour varied among the different cultivar were cream (Manohar), yellow (Dudhsagar) and black (Desi Malbhog and Kalibhog). Purple brown colour dominant of male flower observed in Manohar

and Kalibhog, whereas Dudhsagar, Martaman and Desi Malbhog were cream colour.

4. CONCLUSION

These results indicate that out of 12 different characters of male bud the characters i.e. wax on the bract, compound tepal basic colour, ovary shape, anther colour are the most dominant characters in these 10 cultivars. It will help us to characterize different cultivars, also to evaluate the relationship among the different genotypes.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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