

Vitamin C and Total Sugar Content Characterization on 31 Accessions of Banana Collection of Banana Germplasm Plants of Yogyakarta

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Abstract

Banana is one of the tropical fruits that people like because it tastes good and contains good nutritional value that beneficial for health. The content of vitamin C and total sugar are an important character to complete the morphological characterization of banana accession that can be utilized by breeders in choosing accession as parent. The study aimed to determine the content of vitamin C and total sugar on 31 accessions of banana collection of Banana Germplasm Plants of Yogyakarta. The research was conducted at Banana Germplasm Plantation and Laboratory of Agricultural Technology Production of Gadjah Mada University, Yogyakarta from January to December 2016. The results indicated that 31 banana accessions showed their susceptibility to vitamin C content 60.42 ± 39.22 mg / 100 g and total sugar $22.06 \pm 16.01\%$. High standard deviation values indicate the large diversity of banana accessions that were characterized, indicating that the accessions of each characterized banana were separate accessions of one another.

Keywords: Characterization; banana; vitamin C; total sugar.

INTRODUCTION

Banana is one of the tropical fruits that people like because it tastes good and contains good nutritional value that beneficial for health. In addition to the relatively cheap price, banana was also one of the plants that have bright prospects because everyone in the whole world almost likes to consume bananas (Komaryati & Adi, 2012).

Indonesia is one of the centers of banana plant genes (Sukartini, 2007). Therefore, in 1988, the Government of Yogyakarta Special Region develop the Banana Germplasm Garden and has been carry out the collection, maintenance and dissemination of various collections of bananas. With a land area of 19,525 square meters, this garden already has 346 varieties of bananas originating from Indonesia and from abroad (Kristamtini et al., 2016). The Banana Germplasm Garden of Yogyakarta was called as the most complete collection of banana conservation garden in Indonesia by the Ministry of Agriculture of Indonesia.

Indonesia has a high diversity of bananas, this condition was very helpful for breeding program in producing superior varieties. The superior varieties of bananas were expected to have high productivity, good quality, early age, resistant to certain pests and tolerance to environmental stress. On the other hand, in the banana diversity was not yet widely known for its characteristics. To support the assembly of superior

varieties of bananas, it was necessary to characterize and evaluate existing germplasm. The information obtained from characterization and evaluation, can be used as a material for improving the character through a plant breeding program.

Banana plants have diverse morphological characters. Each banana plant has its advantages and disadvantages based on its morphological appearance (Wardiyati et al., 2004). As the first step of breeding program to get information about morphological character of a plant was needed characterization activity (Subandiyah, 2002). As Simmonds & Shepherd (1955) have pointed out, one of the first steps to recognize the magnitude of such biodiversity was to identify genetic diversity. One approach to identifying a banana plant is to use morphological characters that include leaf, stem, fruit, and flower characters (Wardiyati et al., 1997) Plant breeders can utilize the plant after knowing the character thoroughly through exploration, collection, characterization, evaluation and selection (Wardiyati et al., 1997).

Morphological characterization is the preliminary information required in seeking superior characters and the diversity that was still in need (Santos et. al., 2003). Morphological characters were considered still not enough to find a clear position so that other methods as complement to evaluate kinship. One method was to do chemical characterization by analyzing the content of vitamin C and total sugar. The content of vitamin C and

total sugar becomes the character that differentiates between accessions, because bananas contain high enough nutrients and high of vitamin C. In addition the content of Vitamin C and total sugar was the required character in the description of banana plants

The aim of this research was to know and get the diversity of 31 accessions of banana collection of Banana Germplasm Garden of Yogyakarta based on vitamin C and total sugar content so that the relation of various bananas based on vitamin C and total sugar content are known.

MATERIALS AND METHODS

The experiment was conducted at Banana Germplasm Plantation and Agricultural Production Technology Laboratory of Gadjah Mada University, Yogyakarta from January to December 2016. Thirty-one accessions of banana as research material are presented in Table 1. Banana tree ripe fruit was analyzed for vitamin C and total sugar content. The analysis of sugar content using Nelson Somogyi method, while analysis of vitamin C content using iodometric titration method.

Table 1. The banana accessions and its origin.

No	Name	Origin
1	Ambon Jaran	Bantul
2	Ambon Sepet	Gunung Kidul
3	Ambon Warangan	Kulon Progo
4	Anjasmoro	Sleman
5	Australi	KBH Dongkelan
6	Gajih Putih	Kulon Progo
7	Kepok Brentel	Bantul
8	Kepok Bung	Kulon Progo
9	Kepok Hijau	Sleman
10	Kepok Kuning	KBH Dongkelan
11	Kidang Hijau	Sleman
12	Kluthuk Susu	Yogyakarta
13	Koja Pretel	Gunung Kidul
14	Koja Sirimentak	Gunung Kidul
15	Lempereng	Kulon Progo
16	Mangsan	Sleman
17	Mas Raja	Sleman
18	Mas Sloka	Kulon Progo
19	Mas Tropong	Sleman
20	Morosebo	Yogyakarta
21	Potho Merah	Bantul
22	Raja Bagus	Yogyakarta
23	Raja Bandung	Bantul
24	Raja Lini	Gunung Kidul
25	Raja Pulut	Yogyakarta
26	Raja Sabrang	Kulon Progo
27	Raja Sawi	Sleman
28	Raja Sewu	Yogyakarta
29	Rejang	Sleman
30	Serawak	Kulon Progo
31	Triolin	Bantul

The data of vitamin C content and total sugar were analyzed by cluster method using hierarchical cluster analysis to know the kinship relationship with the help of SAS ver software 9.2. Hierarchical cluster analysis was a common way to grouping objects in groups that share the same resemblance to each other.

RESULTS AND DISCUSSION

The content of vitamin C and total sugar in 31 accessions of bananas is presented in Table 2. The content of vitamin C and total sugar from 31 banana accessions varies according to their genetic potential, with an average vitamin C content of 60.42 ± 39.22 mg/100 g, average of total sugar $22.06 \pm 16.01\%$. The highest vitamin C content is owned by the Mangsan accessions (149.34 mg/100g) and the lowest is owned by the Mas Raja accessions (12.79 mg/100g). The content of vitamin C in 31 accessions of bananas is a hint of accession of bananas to be selected for consumption as fresh fruit that is beneficial to health.

Table 2. The content of vitamin C and total sugar of 31 bananas accessions.

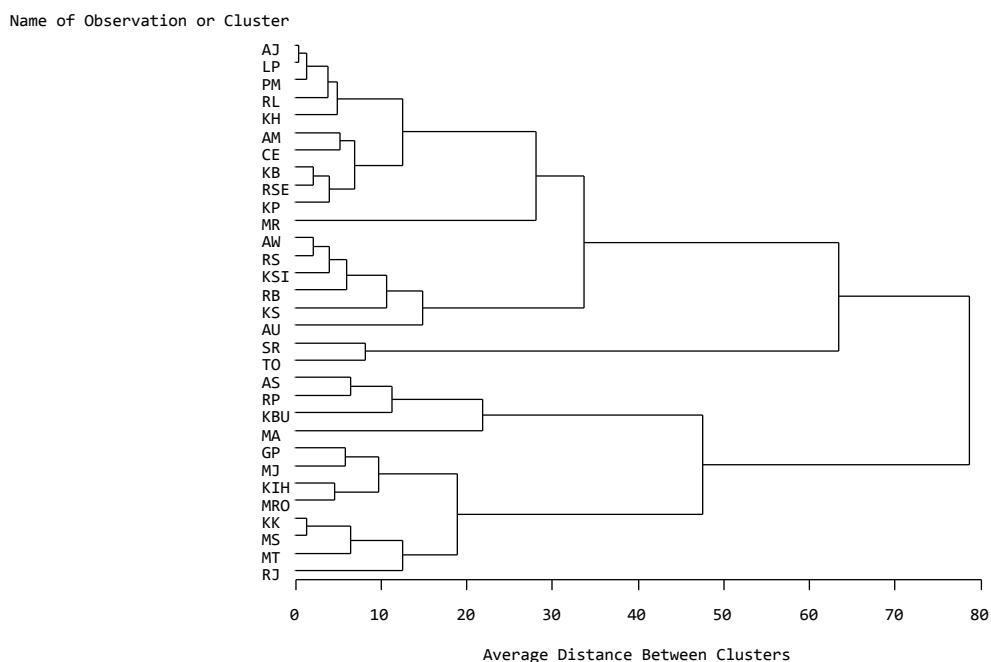
Bananas Accessions	Vit C (mg/100 g)	Total Sugar (%)
1. Ambon Jaran	20.41	20.41
2. Ambon Sepet	128.20	18.54
3. Ambon Warangan	52.44	15.19
4. Anjasmoro	34.38	17.01
5. Australi	53.14	2.42
6. Ceni	36.50	21.70
7. Gajih Putih	76.14	10.66
8. Kapok Brentel	30.85	20.31
9. Kepok Bung	135.69	17.25
10. Kepok Hijau	23.34	23.34
11. Kepok Kuning	93.48	18.99
12. Kidang Hijau	82.93	17.90
13. Klutuk Susu	61.70	21.36
14. Koja Pretel	27.39	22.73
15. Koja Sirimentak	50.38	13.20
16. Lempereng	20.52	20.07
17. Mangsan	149.34	14.36
18. Mas Jambe	75.53	16.38
19. Mas Raja	12.79	44.85
20. Mas Sloka	92.15	18.99
21. Mas Tropong	98.84	16.96
22. Morosebo	85.78	14.31
23. Potho Merah	19.40	19.40
24. Raja Bandung	57.93	15.66
25. Raja Lini	17.79	22.97
26. Raja Pulut	122.29	20.94
27. Raja Sabrang	54.43	15.64
28. Raja Sewu	31.08	22.31
29. Rejang	104.37	10.88
30. Serawak	17.38	81.80
31. Triolin	16.62	73.72
Average + SD	60.92±39.22	22.06±16.01
Min - Max	12.79-149.34	2.42-81.80

Vitamin C or ascorbic acid is needed for health. In human body vitamin C serves as an antioxidant that can protect the body, especially cellular DNA from damage due to oxidation of free radicals. Antioxidants prevent oxidative stress and play an important role in the development of chronic and degenerative diseases such as cancer, arthritis, autoimmune disease, cardiovascular and neurodegenerative diseases (Lian et al., 2008 in Harifah et al., 2017). Daily requirement for vitamin C vary for each individual, in general experts estimate that 60 mg per day is enough but in certain conditions the body requires more than that (Sitohang, 2006). Based on Widya Karya Nasional Pangan dan Gizi V (1993), the requirement of vitamin C per day for baby (7-12

months) is 35 mg, children (7-9 year) is 45 mg and women and men (20 - 59 year) is 60 mg.

It appears in Table 2 that accessions of bananas that have a high vitamin C content followed by a low total sugar content. This means that there is a negative correlation between vitamin C content and total sugar on 31 accessions of bananas observed. Correlation analysis result showed negative correlation equal to - 0.41.

Furthermore, from the chemical characteristic data of vitamin C content and total sugar was used for cluster analysis with the result of dendrogram in Figure 1.



Information:

1. Ambon Jaran	: AJ	12. Kidang Hijau	: KIH	22. Morosebo	: MRO
2. Ambon Sepet	: AS	13. Klutuk Susu	: KS	23. Potheo Merah	: PM
3. Ambon Warangan	: AW	14. Koja Pretel	: KP	24. Raja Bandung	: RB
4. Anjasmoro	: AM	15. Koja Sirimentak	: KSI	25. Raja Lini	: RL
5. Australi	: AU	16. Lempereng	: LP	26. Raja Pulut	: RP
6. Ceni	: CE	17. Mangsan	: MA	27. Raja Sabrang	: RS
7. Gajih Putih	: GP	18. Mas Jambe	: MJ	28. Raja Sewu	: RSE
8. Kapok Brentel	: KB	19. Mas Raja	: MR	29. Rejang	: RJ
9. Kepok Bung	: KBU	20. Mas Sloka	: MS	30. Serawak	: SR
10. Kepok Hijau	: KH	21. Mas Tropong	: MT	31. Triolin	: TO
11. Kepok Kuning	: KK				

Figure 1. Dendrogram of 31 banana accession of Banana Germplasm Garden collection of based on vitamin C and total sugar content.

Dendrogram of Figure 1 shows the kinship relations of 31 banana accessions based on vitamin C and total sugar content. There appears to be some accessions that have very close kinship i.e. accession AJ (Ambon Jaran) with accession LP (Lempereng); and accession KK (Kepok Kuning) with MS accession (Mas Sloka). But

among these accessions there is no equal accession to other accessions, meaning there is no duplication of names between the accessions. And each accession is a separate accession with one accession to another. This result is supported by the morphological character of the fruit, presented in Figure 2.

Dendrogram of Figure 1 shows that 31 banana accessions based on vitamin C content and total sugar were divided into 5 groups. Group I consists of 11 accessions of bananas ie: AJ (Ambon jaran); LP (Lempereng); PM (Potho Merah); RL (Raja Lini); KH (Kepok Hijau); AM (Anjasmoro); CE (Ceni); KB (Kepok Brentel); RSE (Raja Sewu); KP (Koyo Pretel) and accession of MR (Mas Raja). Group II consists of 7 accessions of bananas ie: AW (Ambon Warangan); RS (Raja Sabrang); KSI (Koyo Sirimentak); RB (Raja

Bandung); KS (Kluthuk susu); AU (Australi);. Group III consists of 2 accessions of bananas ie: SR (Serawak); and TO (Triolin). Group IV consists of 4 accessions of bananas ie: AS (Ambon Sepet); RP (Raja Pulut); KBU (Kepok Bung); And MA (Mangsan); and Group V consists of 8 accessions of bananas ie: GP (Gajah Putih); MJ (Mas Jambe); KIH (Kidang Hijau); MRO (Morosebo); KK (Kepok Kuning); MS (Mas Sloka); MT (Mas Tropong); And RJ (Rejang).

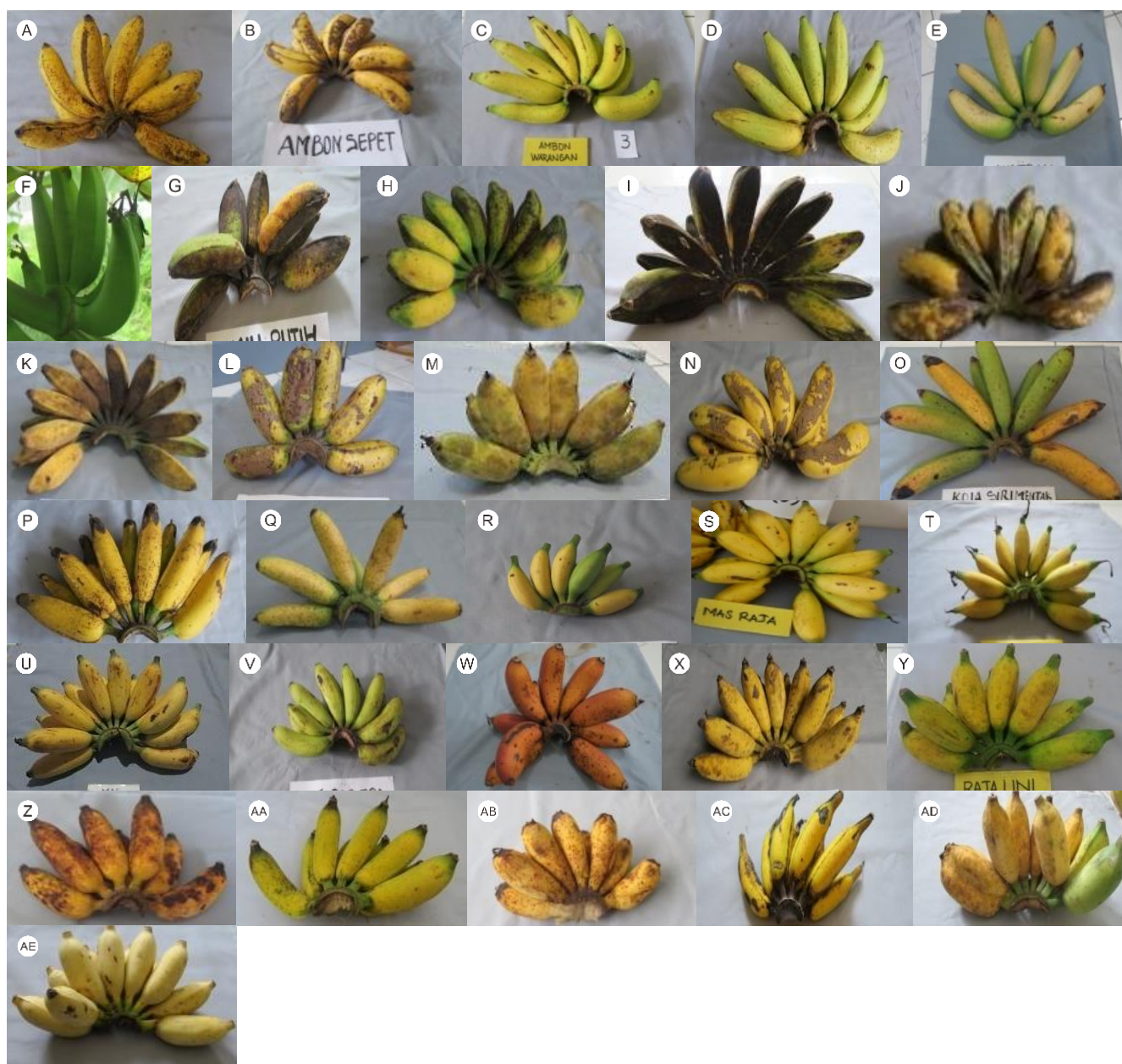


Figure 2. Bananas fruit of 31 bananas accessions. (A). Ambon Jaran; (B). Ambon Sepet; (C). Ambon Warangan; (D). Anjasmoro; (E). Australi; (F). Ceni; (G). Gajah Putih; (H). Kepok Brentel; (I). Kepok Bung; (J). Kepok Hijau; (K). Kepok Kuning; (L). Kidang Hijau; (M). Kluthuk Susu; (N). Koyo Pretel; (O). Koyo Sirimentak; (P). Lempereng; (Q). Mangsan; (R). Mas Jambe; (S). Mas Raja; (T). Mas Sloka; (U). Mas Tropong; (V). Morosebo; (W). Potho Merah; (X). Raja Bandung; (Y). Raja Lini; (Z). Raja Pulut; (AA). Raja Sabrang; (AB). Raja Sewu; (AC). Rejang; (AD). Serawak; (AE). Triolin.

CONCLUSION

From the result we draw conclusion as follows:

1. The content of vitamin C and total sugar from 31 accessions of bananas vary according to their genetic potential, with an average vitamin C content of 60.42 ± 39.22 mg/ 100 g and average total sugar $22.06 \pm 16.01\%$.
2. Each banana accession from 31 accession was a separate accession one with another accession and is divided into 5 groups based on vitamin C content and total sugar.

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