Agrinova: Journal of Agriculture Innovation
Volume 3 (1), 2020, 001-005
Available online at https://jurnal.ugm.ac.id/Agrinova/

UNIVERSITAS GADJAH MADA
PUSAT INOVASI AGROTEKNOLOGI

Artikel

CHARACTERIZATION OF COSMOS (*Cosmos* spp.) ACCESSIONS FROM THE SPECIAL REGION OF YOGYAKARTA AND RIAU ORIGIN

Mhd Irfan Hilmi[1*], Taryono[1,2], Rahmi Sri Sayekti[2]

[1*]Faculty of Agriculture, Universitas Gadjah Mada, Yogyakarta, Indonesia
[2]Agrotechnology Innovation Centre, Universitas Gadjah Mada, Yogyakarta, Indonesia

*Correspondence Email: mhd.irfan.h@ugm.ac.id

ABSTRACT

Cosmos has the potential to be developed as an alternative vegetable. Less characterization and evaluation of cosmos become obstacles in the process of its development. Characterization is the process of observing and identifying the physical, biological, and chemical properties of plants that aim to determine the characteristics of a plant. The purpose of this research is to find the characteristics of each accession of *Cosmos* spp. and get accession of *Cosmos* spp. which has the potential to be developed or used as varieties material assembly. The research was conducted at the AIC (Agrotechnology Innovation Center) of Universitas Gadjah Mada in March-July 2019. The planting material used for this study was the collection of seeds of PIAT UGM from the Special Region of Yogyakarta and Riau. Fifteen cosmos accessions came from DIY and the other 18 came from Riau. Thirty-three accessions have diverse characteristics especially flower colours that are divided into 7 groups of flower colours namely yellow, gold, light orange, orange, pink, purple, and white. Accession number 39 has a rare white colour flower.

Keyword: accession, characterization, cosmos, vegetables

INTRODUCTION

Cosmos as a vegetable crop with many benefits which has not been optimally developed. Cosmos has not been widely cultivated and can only be found in certain markets. In fact, in Indonesia cosmos is a vegetable plant that has a wide diversity, so that if it is developed and cultivated properly it will have the potential as an alternative local vegetable. Cosmos is a tropical plant that is easy to grow, and its distribution in Indonesia is so wide. However, the characterization and evaluation is still limited and needs to be done immediately. To know the characteristics of cosmos it is necessary to characterize the diversity of cosmos in Indonesia. This process is the initial process of developing cosmos.

The problem faced in the cultivation of cosmos is that cosmos is not known as a vegetable and its benefits are not yet known by the wider community (Revianto *et al.,* 2017). The availability of good and quality planting material is also a challenge in cultivating cosmos. Because Indonesia has a diversity of local vegetable genetic resources, proper characterization and evaluation must be carried out to support breeding activities. Jatsiyah (2015) explored and characterized and obtained 20 accessions of cosmos in West Java that

have diversity, whereas Hermanto (2008) characterized 8 accessions of cosmos in Pandeglang district and had diverse characteristics. Exploration, characterization and identification are very important steps in the process of developing local vegetables, because genetic information is very important in the process of determining breeding material in plant breeding (Denton & Nwangburuka, 2011).

Opabode & Adebooye (2005) said that in general, some of the main and most important problems in local vegetables are genetic resource that has not been characterized and not well-collected, even the occurrence of genetic erosion. Characterization is the process of observing and identifying the physical, biological, and chemical properties of plants that aim to determine the characteristics of a plant. Morphological identification is an activity to see the characteristics of a cultivar/accession that can be visually distinguished among its phenotypes (Sudjijo, 2008). Information about the characteristics of cosmos morphology is useful for the utilization and potential for further development of cosmos and can preserve its genetic potential (Jatsiyah, 2015).

MATERIALS AND METHODS

The research was conducted at the AIC (Agrotechnology Innovation Center) of Universitas Gadjah Mada in March-July 2019. The materials used were seeds of 33 accessions of *Cosmos* spp. This research used a Completely Randomized Design (CRD) with one treatment factor as an accession numbers of 33 numbers and each treatment consisted of 20 plants. Each accession is planted in rows with spaces between rows 30 cm and spaces in rows 25 cm.

Observation of the characteristics was done based on cosmos characterization guidelines issued by UPOV (2015) and AVRDC cosmos characterization sheets (2015). Variables observed include plant (growth habit, height, and width), stem (number of branches, colors, and pubescence), leaf (length, width, colors, number of lobes, and pubescence), flower (color, number of petals, number of layers and collar segment). All colected data were descriptively analysized using R.

RESULTS AND DISCUSSION

From the results of observations of the characteristics of the stem (Table 1), it can be concluded that the dominant growth habit is semi-upright with a proportion that exceeds 50% that is equal to 72.73%, then followed by the type of spreading with a proportion of 15.15% and upright growth habit with a proportion of 12.12%. Four accessions that show upright growth habit are accessions 41 and 37 which are classified tall plants, accessions 42 and 28 which are classified as short accessions. Differences in growth type occur due to differences in genetic material and the environment (Adinugraha et al. 2013). In the stem pubescence, 7 accessions do not have pubescence, while 26 other accessions have pubescence in the stem with the proportion of 18,18% pubescence is low, 33.33% is intermediate pubescence, and 27.27% has many pubescence.

Table 1. Stem Morphological Characteristics of 33 Cosmos Accessions

Characteristics	Sub Characteristics	Accessions ∑	Proportion of Sub Characteristics (%)
Growth Habit	Upright	4	12.12
	Semi Upright	24	72.73
	Spreading	5	15.15
Stem Color	Light Green	10	30.30
	Green	6	18.18
	Dark Green	6	18.18
	Purple	7	21.21
	Dark Purple	4	12.12
Stem Pubescence	None	7	21.21
	Low	6	18.18
	Intermediate	11	33.33
	Many	9	27.27

Observations on the stem colour provide difference results. Cosmos plants can have stem colours from green to purple (Bunawan *et al*., 2014). Ten accessions have a light green stem with a proportion of 30.30%, while of green and dark green have a proportion of 18.18%, purple and dark purple with a proportion of 21.21 and 12.12%, respectively. One of the substances that affect stem colour is anthocyanin (Du *et al.,* 2015). The darker stem colour tends to have stronger anthocyanin content (Jatsiyah, 2015). Anthocyanin can play an important role in protecting plants from various abiotic and biotic stresses (Priska *et al.,* 2018). In addition to genetics, several factors that influence anthocyanin content in plants are sunlight (intensity), air temperature, and pH (Akhda, 2009, *cit.* Pebrianti *et al.,* 2015). The content of anthocyanin has human health benefits as bioactive compounds that can prevent various chronic diseases. In the food sector, anthocyanin is used as an additive in food and beverages (Priska *et al.,* 2018).

Table 2. Stem Morphological Characteristics of 33 Cosmos Accessions

Characteristics	Sub Characteristics	Accessions ∑	Proportion of Sub Characteristics (%)
Leaf Colour	Light Green	4	12.12
	Green	25	75.76
	Dark green	4	12.12
Number Of Lobes	Few	1	3.03
	Medium	13	39.39
	Many	15	45.45
	Very Many	4	12.12
Leaf Blade Lobbing	Weak	8	24.24
	Intermediate	17	51.52
	Strong	8	24.24
Leaf Pubescence	Absent	17	51.52
	Present	16	48.48

Cosmos leaf colour shows dominant green with a proportion reaching 75.76%, whereas 4 other accessions have a light green, and 4 accessions have a dark green (table 2). Based on lobe number, 1 accession has few number of lobes which is accession number 13. Thirteen accessions have a medium number of lobes with a proportion of 39.39%. Fifteen other accessios have many number of lobes. Four accessions have many number of lobes, namely accessions number 41, 34, 27 and 19. Qualitative characteristics (colour and shape) in plants are controlled by simple genes (one or two genes) and are slightly influenced by the environment (Kuswandi *et al*., 2014). In leaf pubescence characteristic, cosmos plants are divided into 2 categories having leaf pubescence and without having leaf pubescence. Seventeen accessions have leaf pubescence, and 16 accessions do not have leaf pubescence.

Table 3. Flower Morphological Characteristics of 33 Cosmos Accessions

Characteristics	Sub Characteristics	Accessions ∑	Proportion of Sub Characteristic (%)
Flower Colour	Yellow	8	22.86
	Gold	2	5.71
	Light Orange	2	5.71
	Orange	7	20.00
	Pink	13	37.14
	Purple	2	5.71
	White	1	2.86
Petal Layers	1	20	57.14
	2	15	42.86
Number of Petals	8	20	57,14
	13	1	2,86
	16	10	28,57
	18	4	11,43
Collar Segment	Absent	8	22,86
	Present	27	77,14

In the leaf blade lobbing characteristic, most of the cosmos observed had leaf blade lobbing in the intermediate category with a proportion of 52.52%. In the other 16 accessions, 8 accessions had weak leaf blade lobbing and 8 again had leaf blade lobbing with a strong category. Fairly high variation in shape, size, and color on mango leaves indicates a considerable genetic diversity (Nilasari *et al*., 2013). One of the factors that influence leaf colour is chlorophyll pigment content in leaves. The difference in chlorophyll pigment content in leaves is influenced by genes because each plant has a difference in expressing genetic code. The ability of chlorophyll biosynthesis is thought not to be similar between species and cultivars (Hasidah *et al.,* 2017), whereas Gani (2006) states that there is a good correlation between the level of leaf colour and nutrient content, both in the soil and on the leaves of paddy plants. Some environmental factors that influence pigment synthesis in plants are temperature, light intensity and soil pH (Mlodzinska, 2009). Based on observations, the diversity of sizes, shapes, and colours of leaves of cosmos tends to be influenced by genetics because these accessions have diverse backgrounds.

There are 7 flower colours with 2 accessions which have 2 colours, namely accession number 14 which has gold and yellow flowers, and accession number 24 which has yellow and light orange flowers due to planting material used come from different field with different purities. The most common flower colour is pink with a proportion of 37.14%. Eight accessions have a yellow flower colour, each of the 2 accessions has a golden and light orange flower colour, and the other 7 accessions have an orange flower colour. Pinilih (2005) said that the flower colour trait in chickpea is controlled by one dominant gene, and the inheritance the flower colour tends not to be influenced by its environment. One accession number 39 has a pretty white flower colour.

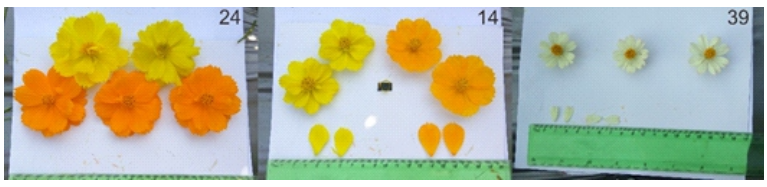

Figure 1. Flowers accessions number 24, 14, and 39

Cosmos accessions observed were divided into 2 categories on the characteristic number of petals layers include accessions that had flowers with 1

layer of petals and accessions that had flowers with 2 layers of petals. Twenty accessions have 1 layer of petals with a proportion of 57.14%, while 15 accessions have 2 layer of petals with a proportion of 42.86%. In the observation of the number of petals there are 4 categories, namely accessions which have the number of petals 8, 13, 16, and 18. The most dominant number of petals is 8 with a proportion of 57.14%. All accessions with 8 petals have 1 layer of petals. Ten accessions have 16 petals, 4 accessions have 18 petals. Accessions with 16 petals are accessions number 8, 23, 24, and 25. There is 1 accession that has petals that are quite different from the others. Accession number 14 with yellow flowers has 13 petals. The last characteristic observed was the presence of a collar segment in flowers. Twenty-seven or 77.14% accessions do not have a collar segment in flowers, whereas 22.86% or 8 accessions have a collar segment in flowers. All accessions that have a collar segment on the flower, are accessions that have 2 layers of petals.

CONCLUSION

1. Thirty-three cosmos accessions have diverse characteristics.
2. Thirty-three cosmos accessions have flower colors that are divided into 7 kinds of flower colors namely yellow, gold, light orange, orange, pink, purple, and white.
3. Accession number 39 has a rare white flower color.

ACKNOWLEDGEMENT

The research can be completed thanks to the guidance, support, and enthusiasm of various parties. The research was funded by Faculty of Agriculture of Universitas Gadjah Mada. The author would like to thank to all who have helped in the completion of this research.

REFERENCES

Adinugraha, H.A., S. Pudjiono, dan Mahfudz. 2013. Variasi Pertumbuhan dan Parameter Genetik Uji Keturunan Jati Umur 5 Tahun di Gunung Kidul, Yogyakarta. Jurnal Pemuliaan Tanaman Hutan 7(3) : 167-178.

Bunawan, H., B. Nataqain, S.N. Bunawan, N.M. Amin, and N.M. Noor. 2014. *Cosmos caudatus* Kunth.: a traditional medicinal herb. Global. J. Pharmacol. 8(3): 420-426.

Denton, O.A., and C.C. Nwangburuka. 2011. Genetic Variability in Eighteen Cultivars of *Solanum anguivi* Lam. Using Principal Component Analysis (PCA) and Single Linkage Cluster Analysis (SLCA). Annals of Biological Researh 2(4): 62-67.

Du, H., J. Wu, K.X. Ji, Q.Y. Zeng, M.W. Bhuiya, S. Su, Q.Y. Shu, H.X. Ren, Z.A. Liu, and L.S. Wang. 2015. Methylation Mediated by An Anthocyanin, O-Methyltransferase, Is Involved in Purple Flower Coloration in Paeonia. Journal of Experimental Botany 66(21): 6563 – 6577.

Gani, A. 2006. Bagan Warna Daun. Balai Besar Tanaman Padi, Sukamandi.

Hasidah., Mukarlina, dan D.W. Rousdy. 2017. Kandungan Pigmen Klorofil, Karotenoid dan Antosianin Daun *Caladium*. Jurnal Probiont. 6(2): 29-37.

Jatsiyah, V. 2015. Kemiripan dan Potensi Produksi Aksesi Kenikir (*Cosmos caudatus* Kunth.) Dari Beberapa Tempat di Jawa Barat. Sekolah Pascasrjana. Institut Pertanian Bogor. Tesis.

Kuswandi., Sobir, dan W.B. Suwarno. 2014. Keragaman Genetik Plasma Nutfah Rambutan di Indonesia Berdasarkan Karakter Morfologi. Jurnal Hortikultura 24(4): 289-298.

Mlodzinska, E. 2009. Survey of Plant Pigments: Molecular and Environmental Determinants of Plant Colors. Acta Biologica Gracoviensia 51(1): 7-16.

Nilasari, A.N., J.B.S. Heddy, dan T. Wardiyati. 2013. Identifikasi Keragaman Morfologi Daun Mangga (*Mangifera indica* L.) Pada Tanaman Hasil Persilangan Antara Varietas Arumanis 143 Dengan Podang Urang Umur 2 Tahun. Jurnal Produksi Tanaman 1(1): 61-69.

Opabode, J.T., and O.C. Adebooye. 2005. Aplication of Biotechnology for The Improvement of Nigerian Indigenous Leaf Vegetables. Afr. J. Biotechnol. 4(3):138-142.

Pebrianti, C., R.B. Ainurrasyid, dan S.L. Purnamaningsih. 2015. Uji Kadar Antosianin dan Hasil Enam Varietas Tanaman Bayam Merah (*Alternanthera amoena* Voss) pada Musim Hujan. Jurnal Produksi Tanaman 3(1): 27-33.

Pinilih, J. 2004. Pewarisan Sifat Warna Bunga, Ukuran Polong dan Bobot Polong pada Persilangan Buncis (*Phaseolus vulgaris* L.) kultivar Rich Green dengan Flo. Fakultas Pertanian. Universitas Gadjah Mada. Tesis.

Priska, M., N. Peni, L. Carvallo, dan Y.D. Ngapa. 2018. Review: Antosianin Dan Pemanfaatannya. Cakra Kimia 6(2): 79-97.

Revianto., A. Rahayu, dan Y. Mulyaningsih. 2017. Pertumbuhan dan Produksi Kenikir (*Cosmos caudatus* Kunth.) pada Berbagai Tingkat Naungan. Jurnal Agronida 3(2): 76-83.

Sudjijo. 2008. Karakterisasi dan Evaluasi Aksesi Pepaya Introduksi. Buletin Plasma Nutfah 14 (2): 81-84.