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SHORT COMMUNICATION

Vol. 8 (3), pp.28 - 30, June, 2020

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Determination of the chromosome number and karyotype of *Platostoma africanum* P. Beauv.

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Abstract

***Platostoma africanum* P. Beauv. is a tropical plant species valued for its efficacy in traditional medicinal system in West Africa. Although studied for its chemical properties, no cytogenetic study has been reported on this plant species. Axillary buds obtained from the growing plants were used to conduct mitotic study. Results obtained in this study showed that *P. africanum* is a diploid species with chromosome number, 2n = 10. The mean chromosome length was 3.93 µm and chromosomes ranged from 3.08 to 5.39 µm, with a haploid set length of 19.64 µm. The karyotype showed assymetry with a formula, 1m+1sm+2a+1t and indicated good adaptation and advancement in evolution in this species. This is the first report of the chromosome number in this indigenous medicinal plant species.**

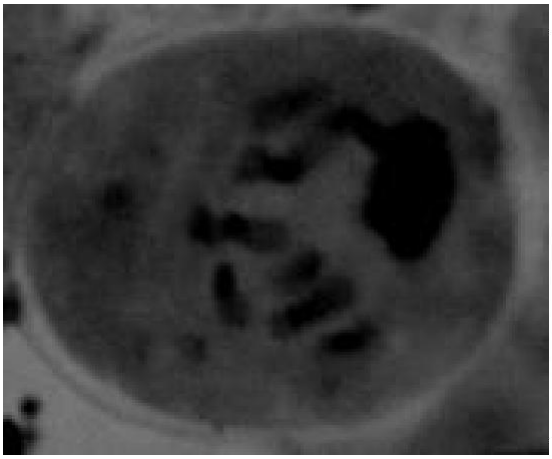
Keywords: Cytology, mitosis, medicinal plants, Lamiaceae.

INTRODUCTION

Platostoma africanum P. Beauv. belong to the plant family Lamiaceae and share some phenotypic similarities with *Ocimum* species, also in the same family. At least 45 species are recognized in the genus *Plastostoma* spp. found in tropical Africa, Madagascar, Tropical Asia and Northern Queensland (Paton, 1997). *P. africanum* is an indigenous African herb known variously as “Akan-Osante” (Ghana), “Akan-brong”, “Guere” “Kru Guere” and Kyama (Ivory Coast), “Mani” (Liberia), “Manding-bambara (Senegal) (Burkill, 1985) and “Mkpri Ibok-ukpong” (Efik-Nigeria). It is widely found in damp sites and waste places in Tropical African countries with a mildly aromatic slight mint or sage odor. The leaves are ovate, acute or abruptly acuminate, with serrated margins at the upper portion, entire and wedge-shaped at the base, terminating with petioles that are 2 to 4 cm long (Akobundu and Agyakwal, 1998). *P. africanum* has slender racemes of very small flowers with white corolla.

P. africanum is used extensively in local traditional medicine in West Africa. In Nigeria, it is used in the treatment of rheumatic symptoms, internal heat and leaves are used as a local haemostatic. It is also sometimes used like *Ocimum* for fever; root mixed with *Tephrosia linearis* (Leguminosae) to make a decoction used internally and externally for feverish chills, rheumatic symptoms. In Ghana, the leaves and seeds are used for children’s coughs. It is also chewed with salt for sore throat and its juice squeezed in the eyes for headache and fever. It is used for stomach medicine in Liberia (Dalziel, 1948; von Reis and Lipp, 1982). Hexane and dichloromethane extracts of the plant have been reported to have anti-inflammatory and antioxidant activities (Aladedunye et al., 2008). It has also been found to contain a chromene derivative, precocene I, an insect anti-juvenile hormone (Onayade et al., 1989).

Although useful in local medicine, this species is largely uncultivated and undomesticated. However, with the discovery of rare essential oil constituents such as monoterpenes, diterpenes and acidic pentacyclic triterpenes (Aladedunye et al., 2008; Onayade et al., 1989), commercial exploitation of this species is inevitable. In this regards, therefore, genetic improvement of the species for greater recovery of essential oil from the plants will become necessary. The lack of basic genetic information on this species poses serious limitation to its genetic improvement. This study was therefore carried out to determine the chromosome number and karyotype of this species in order to provide necessary information for its subsequent genetic improvement.



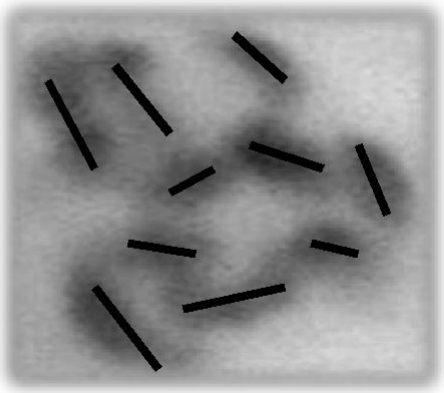


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Figure 1. Somatic metaphase of *P. africanum* showing chromosome number, 2n = 10.

Table 1. Karyotype details of *P. africanum* (2n=10).

Chromosome	Long arm (µm)	Short arm (µm)	Total length (µm)	Arm ratio	Relative length (%)
1	3.85	1.54	5.39	2.5	27.44
2	3.08	1.16	4.24	2.7	2.59
3	2.31	1.54	3.85	1.5	19.60
4	3.08	-	3.08	0	15.68
5	1.54	1.54	3.08	1.0	15.68
Mean	2.77	1.16	3.93		

MATERIALS AND METHODS

Plant materials

Plant samples, identified and confirmed in the herbarium in the Department of Botany, University of Calabar, Nigeria, were grown at the Biological Sciences Building of the University of Calabar in Cross River State, Southeastern Nigeria (Long. 008°21' E, Lat. 04°47'N 4° 56´ N, 155 m above sea level).

Karyotype study

Axillary buds were obtained from the growing plants and pretreated in 8-hydroxyquinoline (0.002M), fixed in Carnoy's solution and hydrolyzed in 1N hydrochloric acid at 60°C. The hydrolyzed materials were rinsed in 70% alcohol and stained with FLP Orcein before squashing and viewing under a light microscope digitized with a Chinese made power shot A630 Canon camera (8.0 megapixel, Canon PC 1201, NO 4126202101). Photographs of good cells were taken. Chromosomes, repeatedly observed and counted from ten metaphase cells, were measured using R1370-19 ocular micrometer calibrated with OB2001 objective micrometer at 0.77 µm per unit and the idiogram of the species was accordingly constructed. Description of chromosomes was based on size, arm length, haploid set length, relative length, symmetry and form (Levan and Sandra, 1964; Pedro and Delgado, 2009; Vargas et al., 2007.

RESULTS AND DISCUSSION

Five pairs of chromosomes were observed for this plant species (Figure 1). The result indicated that the species has a chromosome count of 2n = 10, having a karyotype formula of 1m+1sm+2a+1t with a haploid set length of 19.64 µm (Tables 1 and 2). Mean total length of chromosome was 3.93 µm with chromosome size ranging from 3.08 µm (chromosome 3) to 5.39 µm (chromosome 1). The shortest chromosome constituted 15.68% of the genome with the longest occupying 27.44% of the genome. The mean lengths of the short and long arms were 1.16 and 2.77 µm, respectively.

The cytogenetic details obtained from this study shows that *Platostoma africanum* has an asymmetrical karyotype. This is in accordance with Stebbins (1971) who described asymmetrical karyotypes as those possessing many chromosomes with sub-terminal centromeres or greater differences in size between the longest and smallest chromosomes. The higher proportion of acrocentric (40%) chromosomes as compared to metacentric (20%) chromosomes also depicts that the plant species is not primitive. Levitzky (1931) posited that chromosomes become more

Table 2. Karyotype form of *P. africanum* (%).

Form	Percentage
Metacentric	20
Sub-metacentric	20
Acrocentric	40
Telocentric	20

Karyotype formula – 1m+1sm+2a+1t.

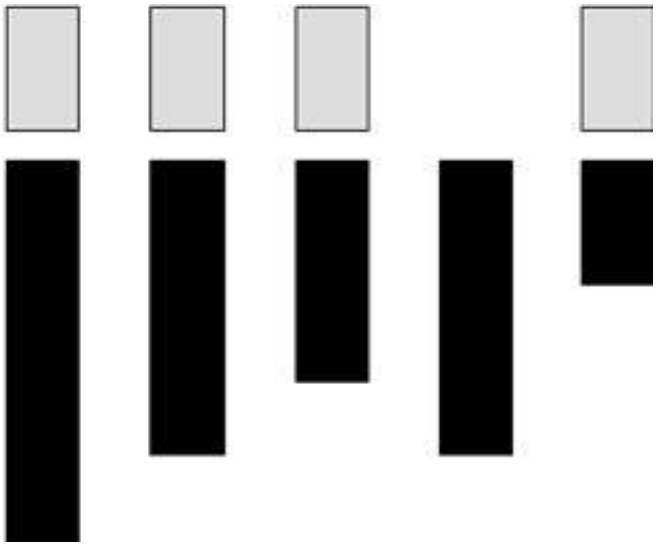

Figure 2. Idiogram of *P. arricanum* (2n=10).

asymmetrical as evolution progresses, moving from sub-metacentric state to acrocentric state in extreme cases. It is known that increased asymmetry of the karyotype through shift of centromere positions, change in relative size of chromosomes in the complement as reported in this study are among trends observed in plant species as they show specialization and adaptation to their environment (Stebbins, 1971). A similar situation observed in this study was reported in *Zamia paucijuga* (Cycadales) where the strongly asymmetrical karyotype indicated recent evolution (Maretti and Sabato, 1984).

Conclusion

In this study *P. africanum* has a chromosome count of 2n = 10, with chromosomes ranging in size from 3.08 to 5.39 µm (Figure 2). This study has further revealed that the plant species has an asymmetrical karyotype, indicative of advancement in its evolutionary trend.

REFERENCES

Akobundu IO, Agyakwal CW (1998*). A Handbook of West African Weeds*. IITA, Ibadan, Nigeria.

Aladedunye FA, Okorie DA, Ighodaro OM (2008). Anti-inflammatory and antioxidant of constituents of *Platostoma africanum.* Natl. Prod. Resour., 22(12): 1067-1073.

Burkill HM (1985). *Platostoma africanum.* Useful Plants of West Tropical Africa 3.

Dalziel J (1948). The Useful Plants of West Tropical Africa. Crown Agents, London U.K.

Levan AF, Sandra AA (1964). Nomenclature for lantromere position of chromosomes. Hereditas, 52: 201-220.

Levitzky GA (1931). Bulletin of Applied Botany, Genetics and Plant Breeding, 27: 220-239.

Maretti A, Sabato S (1984). Karyotype evolution by centromeric fission in *Zamia* (Cycadales). Plant Systematics Evolution, 146: 215-223.

Onayade OA, Looman A, Scheffer JJ, Svendson AB (1989). Procene I and other Constituents of the essential oil *Platostoma africanum*. Planta med., 55(6): 553-555.

Pedro M, Delgado-Salinas A (2009). Karyotype analysis in six species of *Phaseolus*. *Caryologia,* 62(3): 167-170.

Stebbins GL (1971). Chromosomal evolution in higher plants. Edward Arnold, London.

Vargas SM, Torres GA, Sobrinho FS, Pereira M, Davide LC (2007). Karyotype studies of *Catylia argentea* (Desv.), *C. kuntze* and *C. mollis*. J. Genetics Mole. Res., 6(3): 707-712.

Von Reis S, Lipp Jr FJ (1982). New Plant Sources for Drugs and Foods from the New York Botanical Garden Herbarium. Harvard University Press, Cambridge MA.