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Meiotic Chromosome Count for *Chlorophytum sabiense* Omok

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ABSTRACT: *Chlorophytum sabiense* Omok (the newly identified taxon in the family Asparagaceae from the Western Tropical Africa) exhibits some exceptional characteristics having; three ovaries, each with a distinct style and stigmas with few lobes. These features separate *Chlorophytum sabiense* from most species reported in West Africa. Significance of floral characters in taxonomy cannot be overemphasis; as the most reliable morphological feature. In view of this, evidences are required to ascertain true taxonomic statue of the species. In the present contribution, meiotic study was employed as a veritable tool; to investigate pairing pattern of the haploid chromosomes of the species and also to determine the haploid chromosome number for the species. Flower buds at the right age were collected, treated using the conventional method and studied from pachytene to full metaphase. At diakinesis seven bivalents (7 II) were obtained, thus indicate that the species belong to n=7 series of the genus. Seven bivalents (7 II) were however less prevalent (31.9%) compared with multivalents, which indicates high incidence of chromosome stickiness at metaphase I of the species.

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Chlorophytum Ker-Gawl. is a perennial flowering herb in the family Asperagaceace (Angiosperm Phylogeny Group IV, 2016). The genus comprises about 234 species (Gudadhe *et al*., 2012), distributed throughout the old world (Govacrt *et al.,* 2012). Its probable centre of origin and diversification lie in the tropical and sub-tropical Africa and Asia, where 85% of the species are found (Bordia *et al.,* 1995). In West Africa large number of species of *Chlorophytum* are found on the forest floor, while several others occur in the guinea savanna regions (Poulsen and Nordal, 2005; Meerts and Bjora, 2012). *Chlorophytum sabiense* a West African species in the family Asparagaceae is found in the savanna region. The species exhibits variations which set it aside from other species in the genus, having; 3 carpels, each with separate ovary, distinct style and stigma with few lobes (Omokanye, 2020). Comparative morphology and taxonomic study of *Chlorophytum sabiense* and two other notable species in the genus *vis-à-vis Chlorophytum macrophyllum* and *C. stenopetalum* using at least twenty two morphological features led to the following conclusions; that the exceptional characteristics exhibited by *Chlorophytum sabiense* makes it stands out among species in the genus, while its close resemblance with its allies accounts for reason why it had escaped recognition for a long time (Omokanye *et al.,* 2021). The data on chromosome numbers and comparative karyology is fundamental to overall understanding of genome in different species or in morphological diverse populations within a species (Stace, 2000). Federov (1969) and Goldblatt (1984) observed that *Chlorophytum* is a good cytological material, but despite this, cytological information on the genus is very fragmentary. Baldwin and Speese (1951) reported that the genus *Chlorophytum* has polyploidy origin and two basic chromosome numbers (i.e x= 7, 8). Notable Chromosome reports on the genus are those by Pagliarini (1996), Kameshwari *et al.*, (1996), Kameshwari and Muniyamma (2001), Basu and Jha (2008) and Omokanye (2000). Meiotic study is hereby employed as a veritable tool, to determine the haploid chromosome number for *Chlorophytum sabiense*, thus

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providing basic information concerning genomic content of the species.

MATERIALS AND METHOD

Samples of *Chlorophytum sabiense* used for this study were collected from Sabi in Kaduna state, Nigeria and raised in a biological garden in Offa, Kwara state. The samples have remained in cultivation for over five years. The flower buds at the right stages of development were harvested and fixed immediately in freshly prepared Cornoy's solution (3 part of absolute alcohol and 1 part of acetic acid) and preserved in a refrigerator at -4°C for at least thirty minutes, to allow for proper fixing of the cells and the removal of mucilage from the anther. The flower buds were then hydrolyzed in 10% HCl for 3-5 minutes so as to allow for easy removal of the perianth segments. Anthers from hydrolyzed flower bud were squashed on a clean slide on which a drop of acetic orcein stain had been placed. Prepared slides were viewed using an armscope microscope equipped with digital automatic camera.

RESULTS AND DISCUSSION

The meiotic cell division was studied from pachytene/diplotene/diakinesis to metaphase stage. A total of 661 pollen mother cells (PMCs) were studied. At prophase I, the chromosomes condensed and then the homologous pairing was initiated. During the diplotene/diakinesis, bivalents linked by two or more chiasmata were visible (Fig.1 and 2). At diakinesis/ metaphase I, 7 distinct bivalents were observed (Fig.3). Chromosomes associations, of varying configurations were also observed (Fig.4-8).

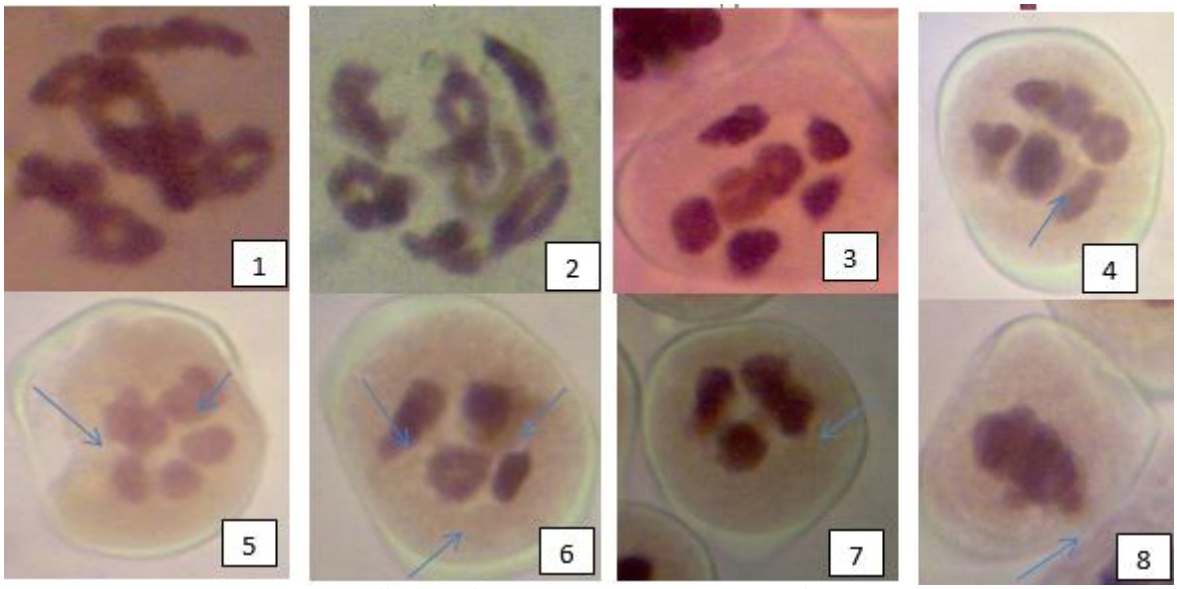

Figure 1-8 show meiotic chromosome and different configurations at diplotene/diakinesis and full metaphase in *Chlorophytum sabiense*; 1, paired chromosome with at least two chiasmata 2. seven bivalents with chiasmata at diakinesis 3, seven distinct bivalents shown at full metaphase 4, six bivalents and one tetravalent (arrowed) 5, three bivalents and two tetravalents (arrowed) 6, one bivalent and three tetravalents (arrowed) 7, two bivalents and one pentavalent (arrowed/) 8, condensed chromosomes.

Table 1. Chromosome pairing configurations (%) at diakinesis in Chlorophytum *sabiense*

C. sabiense	Chromosome	configurations	at	meiotic	metaphase	
Configurations	Bivalents		Multivalents			
	7II	5II+1IV	3II+2IV	1II+3IV	1II+1VI	Condensed chromosomes
Total count/%	211(31.9%)	148(22.4%)	216(32.7%)	33(4.9%)	32(4.8%)	21(3.2%)

The present study constitutes the first report on meiotic chromosomes study of *Chlorophytum sabiense* Omok. (the newly identified species in the family Asparagaceae in the West Tropical Africa). The study revealed seven bivalents (Fig. 3) at diakinesis, in 31.9% of the 661 pollen mother cells (PMCs) studied. Seven bivalents (n=7) is therefore regarded as the haploid chromosome number for the species, being the highest number of bivalents counted per cell, besides multivalents formed added up to seven bivalents. The study thus suggests a diploid number of 2n=14 for the species. Baldwin and Speese (1951) had reported that the genus *Chlorophytum* has polyploidy origin and two basic chromosome numbers (i.e x= 7, 8). The result thus showed that *Chlorophytum sabiense*, belongs to the 7-basic euploid series in the genus, as in *C. stenopetalum* (Omokanye

2016), *C. heyneanum* (Thomas 1960, Sheriff 1967) and *C. laxum* (Baldwin and Speese 1951).

In addition to seven bivalents (n=7), meiotic analysis of *C. sabiense* at metaphase I showed chromosome stickiness characterized by intense clustering of chromosomes of varying degrees. Multivalents (Fig. 4-7) are formed when a few chromosomes of the genome are involved, as observed by Peerzada *et al.*, (2013) in *Inula racemosa*. In extreme cases the entire chromosomal complements converge and condensed together (Fig. 8). Higher incidence of multivalents recorded (68.08%) compared with normal bivalents (31.9%) is noteworthy. This abnormality may affect normal chromosomes distribution at later stages. Chromosomal stickiness can occur due to the presence of mutant genes (Kaul and Murthy 1985) or abiotic factors as high temperatures and herbicides. Pagliarini (2000) attributed chromosome stickiness to genetic and environmental factors and several agents have been reported to cause chromosome stickiness. Olorode (1972), also observed that meiotic irregularity such as multivalents, univalents laggard and non-disjunction in some Nigerian plants to structural heterozygosity or Polyploidization. High incidence of chromosomal stickiness reported here could probably provide answers to some questions on how meiotic regularities affect seeds production and viability in the species. Despite the floral morphology which distinguished *Chlorophytum sabiense* from its relatives, the study substantiates the claim that the species belongs to the genus *Chlorophytum*, as it established meiotic chromosomes count of seven bivalents for the species, which is in consonant with those reported for most species the genus.

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