Kinetin Induces Chromosomal Abnormalities in African Blue Lily
\( (Agapanthus praecox\ ssp.\ minimus)\) Grown in In Vitro
(Kinetin Mencetus Keabnormalan Kromosom dalam Lili Biru
\( (Agapanthus praecox\ ssp.\ minimus)\) yang Dihasilkan secara In Vitro

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ABSTRACT
Kinetin has been reported to exert inhibitory effect when used in tissue culture and in some cases reverse the action of auxin and cause growth inhibition and retardation of root formations. Kinetin also acts as ‘mitotic poison’, mimicking the effect of pesticides and toxic chemicals and interferes in mitosis mechanism of plants. The effect of kinetin on size of cell and nucleus as well as chromosome behaviour in root tip meristems of \( Agapanthus praecox\ ssp.\ minimus \) was studied. The results showed that prolong exposure to kinetin caused chromosome abnormalities to occur more frequently. Chromosome breakage yielded fragmented chromosomes, while abnormal spindle fibers caused delay in chromosome movement, termed as laggard chromosomes. Abnormal nucleus was also observed with kinetin treatments, such as micronucleus, binucleated and tripolar cells.

Keywords: Binucleated; chromosome behavior; cytomixis; fragmented chromosome; kinetin; laggard

ABSTRAK

Kata kunci: Binukleat; kelakuan kromosom; kinetin; kromosom terserpih; sitomiksis; terkemudian

INTRODUCTION
\( Agapanthus praecox\ \) ‘Lily of the Nile’ or the ‘African Lily’ originated from South Africa and is gaining popularity around the world as an ornamental and for landscaping. \( Agapanthus\) plants are popular among native tribes of Africa as a traditional remedy to ease prolonged labour (Varga & Veale 1997). The plant was reported to contain active pharmaceutical agent such as phytoecdysteroids (Savchenko et al. 1997), sapogenins and saponins and showed anti-inflammatory activities. \( Agapanthus\) extracts also possess fungitoxic properties against various bacterial and fungal pathogens (Pretorius et al. 2002; Singh et al. 2008; Tegegne et al. 2008). Coloured extract from \( Agapanthus\) flowers was reported to contain anthocyanin pigments (Bloor & Falshaw 2000; Yaacob et al. 2011), with potential for production of highly commercialized salt and heat-stable organic dye (Yaacob et al. 2011). The vast benefit and potential of \( Agapanthus\) plants had rendered this species to be an interesting candidate for mass propagation through tissue culture.

Tissue culture technique however can result in some limitations or implications, which arise from strong selection pressure imposed by prolonged culture conditions. Various genetic and epigenetic irregularities can occur in cultured cells, giving rise to non-preferred somaclonal variants (Bayliss 1980; Kaeppler et al. 2000; Kovarik et al. 2012). Somaclonal variation resulted from genetic changes at DNA sequence or chromosomal level and epigenetic regulation during translation (such as DNA methylation and histone deacetylation) can hamper mass propagation of clonal plants. Somaclonal variation is also triggered by genomic shock or plasticity (Cullis 2005), especially when plants have exhausted its normal physiological response mechanism to withstand environmental stress (Cullis 1999). Other external factors have also been reported to contribute to development of somaclonal variants, such as type and concentration of plant hormones and explant source (Karp 1991). The exact role of each and relationship between contributing factors underlying the occurrence of somaclonal variation are