Physical stress for overproduction of biomass and flavonoids in cell suspension cultures of *Boesenbergia rotunda*

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**Abstract** Flavonoid, a bioactive compound isolated from the rhizomes of *Boesenbergia rotunda*, exhibited antibiotic and anti-inflammatory properties and has also shown high inhibitory activity of dengue-2 virus protease. Several factors are responsible for the production of flavonoid in cell cultures. In the present study, the effects of initial inoculation volume, temperature and speed of agitation on cell growth, total and selected flavonoid in suspension cultures of *B. rotunda* were determined. High performance liquid chromatography analysis showed that a 2% inoculation volume induced a significantly high accumulation of biomass and of flavonoid in the cells. The cells cultured at 25 °C showed significantly high biomass and selected flavonoid accumulation while differences in medium agitation significantly affected the yield of selected flavonoid.

**Keywords** Abiotic stress · Inoculation volume · Cell cultures · Secondary metabolites · Zingiberaceae

**Introduction**

*Boesenbergia rotunda* (L.) Mansf. Kulturpl. (Larsen 1996) is an important medicinal ginger that originated from India and South-East Asia. The pharmacological importance of this plant is mainly because of the occurrence of flavonoid, flavones, essential oil and chalcones (Jaipetch et al. 1982; Pandji et al. 1993; Trakoonlivakorn et al. 2001). Pinostrobin, also known as an antispasmodic agent inhibits aromatase activity, reduces estrogen-induced cell proliferation, mediates reduction of inflammation and elevate the activity of quinone reductase (Le Bail et al. 2000; Wu et al. 2002; Fahey and Stephenson 2002). Cardamonin isolated from this species displayed anti-HIV-1 protease inhibition (Tewtrakul et al. 2003). The *B. rotunda* rhizome has been found to contain panduratin A which could reduce the development of human breast cancer and human colon adenocarcinoma cell (Kirana et al. 2007). A significant finding revealed that 4-hydroxy panduratin A and panduratin A isolated from the rhizome of *B. rotunda* showed robust inhibitory activity towards dengue-2 virus protease (Kiat et al. 2006). Panduratin A also displayed an interesting effect on treating skin aging affected by UV (Shim et al. 2009). Owing to numerous functional pharmaceutical activities, it is of great interest to pursue production of secondary metabolites from *B. rotunda*. Plant cell, tissue and organ culture offer an alternative system for the biological production of bioactive metabolites.

Cell culture has been proposed as a feasible tool in producing numerous plant-derived metabolites since it has been frequently described to accumulate higher quantities of a desired compound in contrast to the intact plant (Zhang et al. 2002). Cell suspension cultures suggest an easy means to study growth and production kinetics which facilitate determining the most favorable conditions for