

学位論文要旨 Dissertation Abstract

氏名 :

Name ANJUM FERDOUS ONA

学位論文題目 : Studies on organogenesis of *Cymbidium* cultured *in vitro*

Title of Dissertation (*In vitro* におけるシンビジウムの器官形成に関する研究)

学位論文要旨 :

Dissertation Abstract

Different environmental factors affecting *in vitro* organogenesis in rhizome-forming type *Cymbidium* (*Cymbidium goeringii* ‘Getsurin’, *Cymbidium encifolium* ‘Saga’ and *Cymbidium kanran* ‘Murotonishiki’), and in PLB (protocorm-like body)-forming type *Cymbidium* (*Cymbidium* Sweet Waffle ‘Tarte’ and *Cymbidium floribundum*) were studied in 4 chapters. **Chapter 1.** Effect of different plant growth regulators (PGRs) and elicitors in modified MS media on the organogenesis in rhizome culture of *Cymbidium* species was studied. The addition of 30 mg/l and 0.1 mg/l adenine sulphate (AdS) to culture media enhanced the regeneration of rhizome and shoot in *Cymbidium kanran* ‘Murotonishiki’ and *Cymbidium goeringii* ‘Getsurin’, respectively. Application of thidiazuron (TDZ) to culture media was found to reduce the organogenesis by developing protocorm-like shoots (PLS) in both *Cymbidium* species. The addition of 0.01 mg/l naphthaleneacetic acid potassium salt (NAA-K) with 0.1 mg/l AdS to the culture media, and addition of sodium hyaluronic acid (0.1 mg/l FCH and 0.01 mg/l FCH-SU; Kikkoman) to PGR free culture media was effective in inducing plantlet in *Cymbidium goeringii* ‘Getsurin’.

Chapter 2. Effects of various light sources and intensities on the organogenesis of different *Cymbidium* species were studied. At 40 $\mu\text{mol}/\text{m}^2/\text{s}$, red LED enhanced the regeneration of rhizomes and shoot in *Cymbidium kanran* ‘Murotonishiki’, and green LED enhanced PLB formation and red LED increased regeneration of shoots and roots in *Cymbidium* Sweet Waffle ‘Tarte’. Light sources with 100 $\mu\text{mol}/\text{m}^2/\text{s}$ intensity were found inhibitory for organogenesis in both species. Alternate green and red LED enhanced PLB proliferation, shoot formation and fresh weight in *Cymbidium* Sweet

Waffle ‘Tarte’.

Chapter 3. The effects aluminum chloride (AlCl_3) under different light sources, polyethelene glycol (PEG), and combined effect of AlCl_3 and PGRs in modified MS media on the organogenesis of different *Cymbidium* species cultured *in vitro* were studied. Culture media supplemented with 1.0 mg/l AlCl_3 enhanced PLB formation under green LED, and shoot formation from PLBs and root formation from shoot under red LED in *Cymbidium* Sweet Waffle ‘Tarte’. It also induced shoots from rhizome and developed roots from shoot under red LED in *Cymbidium kanran* ‘Murotonishiki’. 10 mg/l AlCl_3 in culture media was found inhibitory for the organogenesis because it resulted PLS in both *Cymbidium* species. Addition of PEG to culture media at lower concentrations (< 0.1 mg/l) was not effective but higher concentrations (1.0 - 10 mg/l) acted as an inhibitor for organogenesis in rhizome culture of *Cymbidium encifolium* ‘Saga’. Addition of AlCl_3 to the basal media was found to suppress the activity of 6-Benzylaminopurine (BAP), TDZ and Gibberellic acid (GA_3). Addition of auxin to culture media supplemented with AlCl_3 inhibits the effect of AlCl_3 in rhizome culture of *Cymbidium*.

Chapter 4. Effects of citric acid (CA), and iron salt in modified MS media on the organogenesis of different *Cymbidium* species were studied. Addition of 0.1 g/l CA in culture media reduced the browning intensity in the cultured PLBs of *Cymbidium floribundum*, which significantly increased PLB formation, shoot formation from the PLBs, and root formation from the shoots. Addition of CA in culture media was found ineffective in rhizome culture of *Cymbidium encifolium* ‘Saga’ and *Cymbidium kanran* ‘Murotonishiki’. Reducing iron salt concentrations (Fe-EDTA) at quarter in modified MS medium enhanced the regeneration of shoots and roots, and using CA as an additive increased PLB proliferation in *Cymbidium floribundum*. In *Cymbidium encifolium* ‘Saga’, Fe-EDTA at full concentration in modified MS media enhanced the rhizome branch formation, increased the regeneration of shoots and roots, and developed no protocorm-like rhizome (PLRh).

This study first time reported that AlCl_3 can enhance organogenesis of *Cymbidium in vitro* in PGR free culture media, and can inhibit activity of PGRs on *in vitro* growth of rhizomes. It also confirmed that the responses of organogenetic pathways of PLBs and rhizome culture of *Cymbidium in vitro* to various factors are different. Alternative red and green LED, reduced concentration of iron salt in modified MS media and applying culture media additive like AlCl_3 , CA at lower concentration are suitable for improved PLB proliferation and shoot organogenesis in PLB culture of *Cymbidium*. Red LED, full concentration of iron salt in modified MS media and applying culture media additive like AlCl_3 , sodium hyaluronate at lower concentration are suitable for improved rhizome formation and shoot organogenesis in rhizome culture of *Cymbidium*.