In vitro shoot regeneration and analysis of biochemical, antioxidant and anticancer properties of Ananas comosus var. MD2

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Abstract

Pineapple (Ananas comosus (L.) Merr.) is one of the most important crops in the world. Although the phytochemical compounds of pineapple fruits have been extensively studied, little attention was paid on other parts of the plant. In this study, we developed an efficient in vitro regeneration procedures for A. comosus var. MD2 as well as analyzed the phytochemical composition, antioxidant and anticancer activities in field-grown and in vitro leaf samples. Leaf base explants cultured on Murashige and Skoog medium containing 1.0 mg/L IBA and 2.0 mg/L BAP produced the highest frequency of microshoot induction (100%) with D-leaf length to width ratio of 6:3. Biochemical analysis showed that in vitro leaf samples contained higher amount of carotenoids and anthocyanins but lower total phenolic content and DPPH radical scavenging activity than field-grown leaves. Flavonoids, tannins, sterols and alkaloids were detected in both field-grown and in vitro leaf samples. The methanolic extracts from both samples exhibited low cytotoxic activity against human ovarian SKOV-3 and human breast MCF-7 cancer cells. These results suggested that pineapple leaves might not be suitable to serve as chemotherapeutic agent and further exploitation on other secondary metabolites is required.

Keywords: bioactivity, cytotoxicity, field-grown, in vitro, Ananas comosus

INTRODUCTION

Pineapple (Ananas comosus (L.) Merr.) is one of the most important crops worldwide (FAOSTAT 2015). Over 13 million metric tons of pineapple were harvested globally. In Malaysia, A. comosus variety MD2 has been listed as one of seven high-values and economically important crops under Malaysia’s National Key Economic Areas (NKEA). MD2 is highly demanded in the international market due to its aroma, sugar and vitamin contents as well as its longer post-harvest shelf life. Conventionally, pineapple is propagated vegetatively through suckers. However, this method is slow and may take up to 8 years to generate propagules from single mother plants (Zuraida, Shahnadz et al. 2013). Moreover, it can easily transmit numerous diseases from old to new pineapple plantations. Therefore, an alternative method using plant tissue culture to mass produce disease-free pineapple plantlets in order to satisfy the increasing demand for pineapple fruits is essential.

Harvesting pineapple produces a large amount of waste material (Asim, Abdan et al. 2015). In 2008, about 384,673 metric tons of waste materials, such as leaves, were either burnt or discarded which can later cause pollution and landfill problems. Very small portions of pineapple leaf fibers are being used as feedstock and energy production (Asim, Abdan et al. 2015). Therefore, full utilization of these materials by amplifying industrial usage to minimize the wastage of renewable materials is vital. Instead of treating it as wastes, it is of great effort to evaluate its pharmacological properties for medicinal purposes.

Similar to many plant species, pineapple has many applications in folk medicines. Various parts of the pineapple plants have been used to treat numerous diseases and disorders. Apart from the fruit, stem, leaf, rhizome, root and latex of pineapple have been found to contain numerous medicinal properties. For instance, pineapple leaves have been traditionally used in Chinese medicine as anti-dyspepsia and anti-diarrheal agents (Song, Zhao et al. 2012). Other properties, such as anti-diabetic, anti-dyslipidemic and anti-oxidative, have also been reported (Xie, Xing et al. 2005), indicating its potential to serve as medicine. Besides being utilized as a traditional medicine, pineapple leaves are also used in textiles industry in the Philippines.

In this study, we aimed to mass propagate in vitro pineapple variety MD2 and to evaluate the chlorophyll content, total carotenoids, anthocyanin content, phytochemicals constituent, antioxidant activity and cytotoxicity of in vitro- and field-grown pineapple leaves. This study might provide a new insight into the bioavailability of using pineapple waste material for a new health supplement.

EXPERIMENTAL

Plant materials

Leaf base of in vitro grown A. comosus var. MD2 initiated on Murashige and Skoog (MS) medium supplemented with 1.0 mg/L NAA and 3 mg/L BAP (Hamid et al., 2013) were used as explants for shoot proliferation.

Shoot proliferation and maintenance

The leaf base explants (1 cm in length) were cultured on Murashige and Skoog (MS) medium supplemented with 1.0 mg/L NAA and 3 mg/L BAP (Hamid et al., 2013) were used as explants for shoot proliferation.

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