Enzymatic Activity of Pathogenesis-Related (PR) Proteins of Five Local Banana Cultivars during Ripening

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Abstract

The biochemical activity of five pathogenesis-related (PR) proteins were determined in the peel and pulp of five local banana cultivars, namely ‘Berangan’ (AAA), ‘Mas’ (AA), ‘Abu’ (AAB), ‘Rajah’ (ABB) and ‘Rastali’ (AAB) at four ripening stages, Stages I, III, V and VII. Results showed that peroxidase decreased at later stages of ripening in both the peel and pulp of the fruit. Peroxidase and polyphenol oxidase were observed to be higher in the peel than in the pulp. Conversely, both the α-amylase activity and the trypsin inhibitory activity were observed to be higher in the pulp as compared to the peel of the fruit. Trypsin inhibitory activity was also observed to be significantly higher in the later stages of ripening. The laminarinase assay showed a decrease in activity for all cultivars except the ‘Abu’ cultivar.

INTRODUCTION

Bananas are the most cultivated crop after durian in Malaysia. Popular cultivars include ‘Mas’ (AA), ‘Embun’ (AAA), ‘Rastali’ (AAB) and ‘Berangan’ (AAA) (Abdullah et al., 1990). ‘Berangan’ (AAA) is a major cultivar for local consumption occupying 39% of the total banana cultivated area of 31,917.7 ha (Ministry of Agriculture, 2004). Banana ripening involves various physiological and biochemical changes. The most observable change is color that occurs as the banana fruit turns from green to yellow. The fruit also undergoes an increase in the pH and total soluble solids while the pulp firmness decreases (Kudachikar et al., 2011; Mahajan et al., 2011; Kulkarni et al., 2011). These changes make the fruit more edible, palatable and attractive to consumers. These physiological and biochemical changes are the result of enzymatic action. Studies have shown that the protein profile of the banana fruit changes throughout the ripening process. Toledo et al. (2012) observed 50 proteins that showed differential expression during the ripening process. 26 of those proteins were identified as being important to the fruit quality. Work by Godoy et al. (2009) also lead to the identification of 12 proteins that where differentially expressed in bananas during the ripening process. They theorized the proteins were functional and played an essential role in fruit ripening. We conducted five enzymatic assays to assess the activity of the enzymes during the ripening process. Information on the differential activity during the ripening process could prove invaluable in determining which enzymes play key roles in the fruit ripening process. This could be used to facilitate studies in delaying ripening to fruit shelf-life.

MATERIALS AND METHODS

Fruit of five banana cultivars (‘Abu’, ‘Mas’, ‘Rajah’, ‘Rastali’ and ‘Berangan’) were harvested at the mature green stage (Stage I) from a plantation in Kuala Selangor, located about 50 km from the laboratory. Upon arrival at the laboratory, fruit bunches were dehanded and defingered. The first and last hands of the bunch were discarded. Fruit fingers were washed to remove dirt, insects and other possible contaminants, soaked in 5% Benomyl for 15 min, soaked in distilled water for 15 min, and air-dried. Fruit were