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ORIGINAL ARTICLE

Metabolomic profiling and antioxidant activity of some *Acacia* species

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Flavonoids;
Metabolome;
Multivariate data analysis;
Saponins

Abstract Metabolomic profiling of different parts (leaves, flowers and pods) of *Acacia* species (*Acacia nilotica*, *Acacia seyal* and *Acacia laeta*) was evaluated. The multivariate data analyses such as principal component analysis (PCA) and partial least square-discriminant analysis (PLS-DA) were used to differentiate the distribution of plant metabolites among different species or different organs of the same species. *A. nilotica* was characterized with a high content of saponins and *A. seyal* was characterized with high contents of proteins, phenolics, flavonoids and anthocyanins. *A. laeta* had a higher content of carbohydrates than *A. nilotica* and *A. seyal*. On the basis of these results, total antioxidant capacity, DPPH free radical scavenging activity and reducing power of the methanolic extracts of studied parts were evaluated. *A. nilotica* and *A. seyal* extracts showed less inhibitory concentration 50 (IC_{50}) compared to *A. laeta* extracts which means that these two species have the strongest radical scavenging activity whereas *A. laeta* extracts have the lowest radical scavenging activity. A positive correlation between saponins and flavonoids with total antioxidant capacity and DPPH radical scavenging activity was observed. Based on these results, the potentiality of these plants as antioxidants was discussed.

1. Introduction

Acacia has a wide range of ecological amplitudes and is distributed in many regions all over the world. The genus includes more than 1350 species (Seigler, 2003). In spite of the huge number of *Acacia* species, there are very few researches regarding the phytochemistry of these plants. *Acacia nilotica* is described as a multipurpose medicinal and pharmaceutical plant (Ali et al., 2012). In traditional medicine, *A. nilotica* is used for the treatment of many diseases including tuberculosis, pneumonia, gonorrhea and small pox. *A. nilotica* showed a strong antimicrobial activity against both bacteria and fungi (Saini et al., 2008). Methanolic extract of *A. nilotica* leaves and ethanolic extract of stem bark were investigated against Gram positive and Gram negative bacteria. The results indicated that the extracts revealed antimicrobial activity against both types of bacteria (Mahesh and Satish, 2008; Banso, 2009). The ethanolic extract of *A. nilotica* leaves showed antimicrobial activity against *Campylobacter coli* isolated from

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goats (Solomon-Wisdom and Shittu, 2010). Saini et al. (2008) studied the antimicrobial activity of five species of *Acacia* and the results indicated that *A. nilotica* had the highest antifungal activity against *Aspergillus niger* and *Candida albicans*. Methanolic leaf extract of *A. nilotica* revealed a high antifungal activity against *Aspergillus flavus*, *Drechslera turcica*and *Fusarium verticillioides* (Mahesh and Satish, 2008).*A. nilotica* bark extract prevents hepatic malondialdehyde formation and reduces liver injury (Singh et al., 2009). *A. nilotica* pods have been evaluated for the antihypertensive and antispasmodic activity. Methanolic extract of *A. nilotica* inhibited the spontaneous contraction of rabbit jejunum (Gilani et al., 1999).

Regarding *Acacia laeta*, there are a few studies relating to this species. Many species of *Acacia* are distributed in both Nile valley and desert regions in Egypt. The most common species in Egypt are: *A. nilotica*, *A. laeta*, *Acacia seyal*, *Acacia raddiana*, *Acacia ehrenbergiana* and *Acacia tortilis*. Although there are many studies that have been published regarding the phytochemical composition of *A. nilotica*, there are very few studies dealing with the phytochemistry and antioxidant activity of other species of *Acacia*.

In recent years, metabolomics which is defined as monitoring of metabolite concentration in a cell, tissue, organ or a whole plant (Ott et al., 2003) has become prominent as a part of systems biology. Moreover, metabolomics is of interest in chemical classification of plants for chemotaxonomy. Differentiation between different species of *Acacia* based on their metabolomic profiling has not been carried out yet.

In this study, a spectrophotometric method coupled with different multivariate data analyses such as PCA and PLS-DA was applied to *Acacia* metabolome aiming to investigate the metabolomic variation among different species of

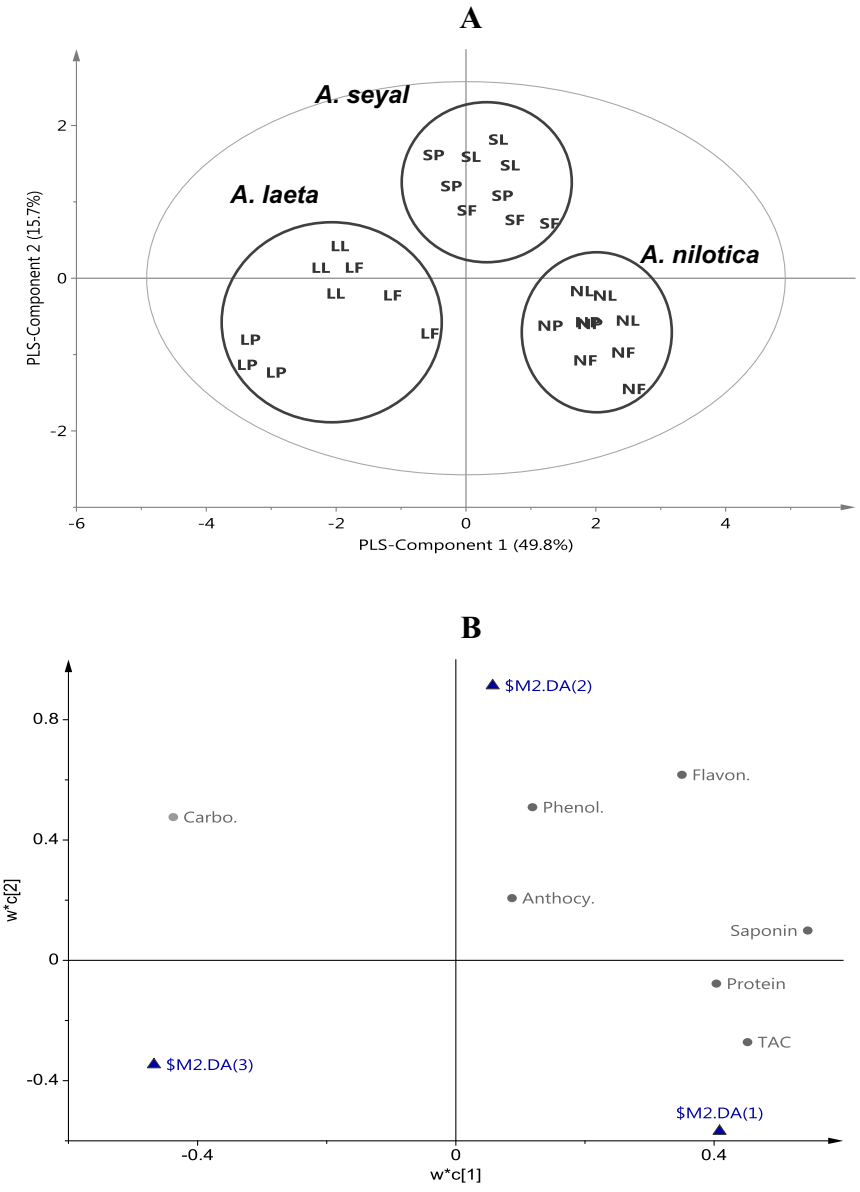

Figure 1 Score scatter plot (A) and score loading plot (B) of PLS-DA of three groups of *Acacia* species. NL = A. *nilotica* leaves, NF = *A. nilotica* flowers, NP = *A. nilotica* pods, SL = *A. seyal* leaves, SF = *A. seyal* flowers, SP = *A. seyal* pods, LL = *A. laeta* leaves, LF = *A. laeta* flowers, LP = *A. laeta* pods.