INTRODUCTION
Black cohosh (Actaea racemosa L.) is a native North American species, where it is widely used as a herbal support for menopausal symptoms. The species is also known under the synonyms Actaea americana. Black cohosh commercial products were ranked in the top 10 supplement sales in the USA. In addition, A. racemosa, there are other North American and Asian Actaea species. Due to the continual increase in sales and collection of A. racemosa, mix up and adulteration with other species has become an increasing threat. A. racemosa is a root and rhizome species and is used as a health supplement for menopausal symptoms and 9 health benefits to the consuming consumers.

The application of UPLC-QTOF-MS for multivariate analysis of black cohosh is a powerful approach in the identification of black cohosh species and commercial products. In the present study, a multivariate statistical method using UPLC-QTOF-MS was used for the classification of different Actaea species and commercial black cohosh products.

METHODS
UPLC-QTOF-MS Ion Identity Map
Figure 2A shows the UPLC-QTOF chromatogram on an Actaea racemosa sample. All samples were split equally for a clear comparison between the North American and Asian species. The last two species, A. biternata and A. pachypoda were used as adulterants. The classification results (not shown) show that the reference black cohosh samples and adulterants were successfully classified into their respective groups with no misclassifications observed. This explain how distinct the LCMS black cohosh chemical profiles were from each other and the potential to be used for species identification.

RESULTS AND DISCUSSION (I)
The Progenesis QI software was used for statistical modelling and is integrated with the reference black cohosh and adulterants species (S. chinensis, A. biternata and A. pachypoda). The model was trained with the authentic black cohosh species showing how distinct the LC/MS black cohosh chemical profiles were from each other and the potential to be used for species identification. The classification results (not shown) show that the reference black cohosh samples and adulterants were successfully classified into their respective groups with no misclassifications observed. This explain how distinct the LCMS black cohosh chemical profiles were from each other and the potential to be used for species identification.

RESULTS AND DISCUSSION (II)
To evaluate the prediction capability of the UPLC-QTOF-MS 15 Actaea species chemical profile, a PLS-DA model was used. The model is based on the Progenesis QI software. Predictive models were created for each of the different species.

RESULTS AND DISCUSSION (III)
The application of UPLC-QTOF-MS for multivariate analysis of black cohosh and its commercial products is a powerful approach for authenticating commercial products sold in the market.

CONCLUSION
The application of UPLC-QTOF-MS for multivariate analysis of black cohosh and its commercial products is a powerful approach for authenticating commercial products sold in the market. The Progenesis QI software was used for statistical modelling and is integrated with the reference black cohosh and adulterants species (S. chinensis, A. biternata and A. pachypoda). The model was trained with the authentic black cohosh species showing how distinct the LC/MS black cohosh chemical profiles were from each other and the potential to be used for species identification. The classification results (not shown) show that the reference black cohosh samples and adulterants were successfully classified into their respective groups with no misclassifications observed. This explain how distinct the LCMS black cohosh chemical profiles were from each other and the potential to be used for species identification. The model was trained with the authentic black cohosh species showing how distinct the LC/MS black cohosh chemical profiles were from each other and the potential to be used for species identification.

Identification of key markers from PLS-DA
To identify the key markers for each 1 species, the PLS-DA loading was used. In each of the 16 black cohosh labelled commercial products (PLS1) 1 of the 16 were selected for each of the different species. The application of UPLC-QTOF-MS for multivariate analysis of black cohosh and its commercial products is a powerful approach for authenticating commercial products sold in the market. The Progenesis QI software was used for statistical modelling and is integrated with the reference black cohosh and adulterants species (S. chinensis, A. biternata and A. pachypoda). The model was trained with the authentic black cohosh species showing how distinct the LC/MS black cohosh chemical profiles were from each other and the potential to be used for species identification. The classification results (not shown) show that the reference black cohosh samples and adulterants were successfully classified into their respective groups with no misclassifications observed. This explain how distinct the LCMS black cohosh chemical profiles were from each other and the potential to be used for species identification. The model was trained with the authentic black cohosh species showing how distinct the LC/MS black cohosh chemical profiles were from each other and the potential to be used for species identification.