Study of Phenolic Compounds in Plants Belonging to the Leguminosae Family (Fabaceae) in Southern Brazil

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ABSTRACT: The Leguminosae family is one of the largest among the dicotyledons. Have been described several types of substances for this botanical family such as phenolic compounds. Nowadays, the interest in the study of these compounds is increasing due to the promising health benefits they can bring such as anti-allergic, anti-atherogenic, anti-inflammatory, antimicrobial and cardioprotective properties. Moreover, they have an important role as chemotaxonomic markers. Then, this study aimed to investigate the presence of these compounds in extracts of 60 plants of Leguminosae by high performance liquid chromatography (HPLC). This analysis identified 15 phenolic substances in the studied species, including phenolic acids, flavonoids and isoflavones, showing that this botanical family offers a wide variety of phenolic substances.

Key Words: Leguminosae, Fabaceae, phenolic coumpounds, HPLC, flavonoids.

RESUMO: ***Estudo de compostos fenólicos em plantas da família Leguminosae (Fabaceae) do sul do Brasil.*** A família Leguminosae é uma das maiores dentre as dicotiledôneas. Já foram descritos diversos tipos de compostos para essa família botânica, incluindo os compostos fenólicos. Estudos sobre estas substâncias vêm aumentando devido aos promissores benefícios à saúde que eles podem trazer, tais como atividade anti-alérgica, anti-aterogênica, anti-inflamatória, antimicrobiana e cardioprotetora. Portanto, este estudo teve como objetivo investigar a presença dessas substâncias fenólicas em extratos de 60 plantas da família Leguminosae por cromatografia líquida de alta eficiência (CLAE). Esta análise permitiu identificar 15 compostos, entre eles ácidos fenólicos, flavonoides e isoflavonas nas espécies estudadas, demonstrando que esta família botânica apresenta uma grande variedade de substâncias fenólicas.

Palavras-chave: Leguminosae, Fabaceae, compostos fenólicos, CLAE, flavonoides.

INTRODUCTION

The family Leguminosae has about 18,000 species distributed mostly at tropical and subtropical regions of the world, and is considered one of the largest among the dicotyledons (JOLY, 1993). Various types of alkaloids, non-protein amino acids, amines, flavonoids, isoflavones, coumarins, phenylpropanoids, anthraquinones, di-, sesqui- and triterpenes, protease inhibitors, lectins and cyanogenic glycosides have been described in this family, most of them acting as chemical defense or signal compounds (WINK and MOHAMED, 2003).

In view of this, the identification of phenolics becomes important since this class of substances has been extensively studied because of evidences of health benefits that they can bring such as anti-oxidant, anti-inflammatory, anti-allergic, anti-microbial, anti-atherogenic and cardioprotective properties (BALASUNDRAM, 2006). Moreover, many of these secondary metabolites are chemotaxonomic markers, since some of them can be specific to some species or varieties (ABAD-GARCIA, 2007).

METHODOLOGY

Plant material. The leaves of 60 different plants belonging to the Leguminosae family were analyzed. The material was collected, provided and identified by botanist Prof. Silvia Teresa Sfoggia Miotto (Department of Botany - UFRGS). Plants were collected at the states of Rio Grande do Sul, Paraná and Santa Catarina (Brazil).

Preparation of samples. After drying at ambient temperature for 7 days, plants were triturated with knife mill and macerated in methanol (1:20) with magnetic stirring. The solvent was renewed three times every 12 hours. After evaporation of the solvent the residue was resuspended in water and lyophilized to obtain a dry extract. The chromatographic analysis was done by HPLC with diode array detector (DAD) with a linear gradient system using as mobile phase A acetonitrile: trifluoroacetic acid (100:0,08) and mobile phase B water: trifluoroacetic acid (100:0,01). A reversed phase column C18 (250x4, 6 mm) with particle diameter of 5 µm was used. For identification of compounds, 32 chemical standards were used to compare their retention times and UV profiles.

Rev. Bras. Pl. Med. v.14, Suppl., 2012.
Caderno de Farmácia, v. 20, n. 2, p. 93-105, 2004

RESULTS AND DISCUSSION

The chromatographic analysis identified 15 compounds in the plants analyzed.

TABLE 1. Phenolic compounds identified in the species analyzed.

Plant species	Compounds
Crotalaria incana L.	9
Crotalaria hilariana	1,6,7,9
Desmodium incanum	9,11,15
Desmodium incanum	4,10
Desmodium adscendens	9, 10
Desmodium adscendens	10,11
Desmodium subsericeum	11, 15
Desmodium uncinatum	11
Desmodium uncinatum	10,11,15
Desmodium cuneatum	8,10,15
Desmodium cuneatum	10,15
Desmodium barbatum	15
Desmodium affine	4,10,15
Desmodium affine	4
Desmodium leiocarpum	15
Desmodium leiocarpum	10,11,5
Eriosema tacuaremboense	10
Eriosema heterophyllum	10
Eriosema campestre	10,11,12,15
Eriosema sp.	10,11,15
Eriosema campestre var. *macrophyllum*	10,15
Eriosema sp.	10,11
Eriosema longifolium	13
Lathyrus crassipes Gillies	12,13
Chamaecrista rotundifolia	10,15
Chamaecrista rotundifolia	10,13,15
Chamaecrista nictitans var. *ramosa*	11
Chamaecrista nictitans var. *ramosa*	10
Chamaecrista nictitans var. *pilosa*	13
Chamaecrista desvauxii var. *molissima*	10
Chamaecrista desvauxii var. *latistipula*	15
Chamaecrista desvauxii	10,13
Mimosa pigra	5,11,13
Mimosa sp.	12,13
Mimosa bimucronata	2,3

1- 3,4-dihydroxybenzoic acid , 2- ellagic acid , 3- gallic acid, 4- apigenin, 5- astragalin, 6- biochanin-A , 7- daidzein , 8- flavone , 9– genistein, 10– isovitexin, 11- luteolin , 12– quercetin, 13– quercetrin, 14- rutin e 15- vitexin.

The flavonoids isovitexin, vitexin and luteolin were the most frequently found. In all species was possible to observe the presence of phenolic compounds, even those in which none of the standards used was identified.

Many of these species has the presence of this class of compounds reported. But many of them have not been studied chemically or these metabolites were not reported.

Through this study, was observed a pattern in the different subfamilies, tribes and genera, which corroborates with the divisions according to evolutionary closeness in the family, since the phenolic compounds are considered as chemotaxonomic markers (ABAD-GARCÍA, 2007).

CONCLUSIONS

Through this study was possible to identify several phenolic compounds, including phenolic acids, flavonoids and isoflavones in different subfamilies, tribes and genera of the Leguminosae family. However, more studies are needed to establish a taxonomic profile.

ACKNOWLEDGMENTS

PROPESQ - UFRGS and CNPq for scholarships and financial support.

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