PHYTOCHEMICAL RESEARCH OF PLANTS USED BY THE ASSOCIATION OF TRADITIONAL MEDICINE AT APILLAPAMPA

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Key words: Traditional medicine, review, Bolivia,

ABSTRACT

A research concerning the medicinal plants reported by the association of traditional medicine in Apillapampa-Bolivia was done; this review covers all the phytochemical scientific information reported for the 158 species reported as medicinal plants until September 2005. The results indicate that 16 % have been deeply studied, 10% was moderately studied, 17% was barely studied, and near the 45% were not studied at all. Among the plants that have some studies only 46 % have shown to be subjected to some kind of biological activity screening. The results show that the Andean traditional medicine is a barely studied field and pretends to serve as a guide for future phytochemical research.

RESUMEN

Se hizo un resumen de la investigación relacionada con las plantas medicinales reportadas por la asociación de medicina tradicional de Apillapampa Bolivia (AMETRAC), el resumen cubre toda la información fitoquímica reportada para las 158 especies de plantas medicinales hasta septiembre del 2005. Los resultados indican que el 16% han sido extensamente estudiadas, 10 % moderadamente estudiada, 17 % vagamente estudiadas y cerca al 45 % no ha sido estudiada en lo absoluto. Entre las plantas que tienen algunos estudios solo el 46 % han sido sometidos a algún tipo de ensayos de actividad biológica. Los resultados aquí presentes muestran que la medicina tradicional andina es un campo muy poco estudiado y pretende ser una guía para futuras investigaciones fitoquímicas.

INTRODUCTION

Bolivia is the Latin-American country that has the largest indigenous population, and because of historical issues, some groups of this population didn't have access to modern medicine, in its absence they kept the knowledge that was transmitted from generation to generation to specific persons which are called Yatiris, Kholliris, Kallawayas or tradicinal doctors. According different authors their origin is dated back to the preincaic era[1], there are also reports of their service to the incas Court, where they had the role of special advisor to the amautas[2] (wise people). In Octuber 2003 the book "Plantas medicinales para la atencion primaria de la salud" was published, this book covers a wide description of uses and botanical identification of the plants, based on the experience and knowledge of eight traditional doctors. The geographical area were the study was located is called Apillapampa, located south east of the Capinota county in Cochabamba Bolivia (17˚ 55' south, 66˚ 15' West).

In the quest for new lead compounds in the pharmaceutical industry, natural products have been a starting point of drugs and drug leads, 61% of the 877 small-molecule new chemical entities introduced as drugs worldwide during 1981–2002 can be traced to or were inspired by natural products[3].

In our attempts to validate the traditional medicine, we present in this article a review of the information available for the different plants presented in the book mentioned before trying in this way; to confirm the properties assigned to the plants, describe the phytochemical composition, analyze the scope of the studies done, and open

new research lines based on the information available.

RESULTS AND DISCUSSION

Information research

The ethno botanic information was collected from the book "Plantas medicinales para la atencion primaria de la salud" by Ina Vandebroek, Evert Thomas and AMETRAC (Association of traditional medics) from Cochabamba Bolivia, the scientific search was done using the SciFinder Scholar Version 2004. Which used the following databases; Reference databases: CAPLUS, MEDLINE, Structure database; Registry and Reaction Databases; CASREACT. Parallel Internet search was done to verify some non reported publications or ethno botanic knowledge (specially for plants with few information).

Definitions

For a better understanding of the terminology used in the present work, and avoid speculations we have made some definitions concerning to different terms used in the present article; **Ethno botanic knowledge**, is referred to information obtained from a reliable source, a scientific publication or public report collected from a traditional medic or person trained in the field, **Scientific information** is any material published in a scientific media, indexed in any of the databases mentioned above. **Phytochemical research** is any research concerning with metabolites from the plant.

Classification

To describe the extent of research done for each plant, a query for the scientific information available to September 11th 2005 was made, the plants were classified in four major groups; a) Highly studied plants (more than 50 references), b) Studied plants (between 10 and 50 references), c) barely studied (at least 1 phytochemical research reference) and d) no Studied, where non phytochemical research was found, a sumary can be found in Table 1.

Table 1. Classification of plants based on information available.

ID	GROUP	Number of components
A	Highly studied	28
B	Studied plants	19
C	Barely studied	31
D	non phytochemical	80

We identify the vegetal distribution between the medicinal plants on the study area, the book reports 168 plant species and 3 lichens described, all the species represent 54 different familys see table 2. The most dominant families are the Asteraceae, solanaceae, Fabaceae, lamiaceae and scrophulariaceae, all together represent 49.1 % of the total population of the plants, 8 specimens couldn't be completely identified two of them seem to be new species, but at the moment the book was published were not confirmed as new species and were not included in the results on the present review. We based the study in the 158 species that have a complete botanical identification.

Table 2. Genus distribution of medicinal plants in apillapampa.

No	FAMILY	Specimens	%	No	FAMILY	Specimens	%
1	Asteraceae	42	26.6	16	Ranunculaceae	2	1.3
2	Solanaceae	13	8.2	17	Polygonaceae	2	1.3
3	Fabaceae	13	8.2	18	Passifloraceae	2	1.3
4	Lamiaceae	9	5.7	19	Loasaceae	2	1.3
5	Scrophulariaceae	7	4.4	20	Iridaceae	2	1.3
6	Cactaceae	5	3.1	21	Geraniaceae	2	1.3
7	Verbenaceae	4	2.5	22	Euphorbiaceae	2	1.3
8	Rosaceae	4	2.5	23	Ephedraceae	2	1.3
9	Mycophycophyta	4	2.5	24	Caryophyllaceae	2	1.3
10	Adiantaceae	4	2.5	25	Brassicaceae	2	1.3
11	Poaceae	3	1.9	26	Berberidaceae	2	1.3
12	Malvaceae	3	1.9	27	Apiaceae	2	1.3
13	Loranthaceae	3	1.9	28	Anacardiaceae	2	1.3
14	Rubiaceae	2	1.3	29	Valerianaceae	1	0.6
15	Rhamnaceae	2	1.3	30	Tropaeolaceae	1	0.6

Table 3. Cont. Genus distribution of medicinal plants in apillapampa.

No	FAMILY	Specimens	%	No	FAMILY	Specimens	%
31	Sapindaceae	1	0.6	43	Crassulaceae	1	0.6
32	Santalaceae	1	0.6	44	Commelinaceae	1	0.6
33	Rutaceae	1	0.6	45	Chenopodiaceae	1	0.6
34	Primulaceae	1	0.6	46	Buddlejaceae	1	0.6
35	Polypodiaceae	1	0.6	47	Bromeliaceae	1	0.6
36	Plantaginaceae	1	0.6	48	Begoniaceae	1	0.6
37	Piperaceae	1	0.6	49	Basellaceae	1	0.6
38	Oxalidaceae	1	0.6	50	Ascepiadaceae	1	0.6
39	Krameriaceae	1	0.6	51	Araceae	1	0.6
40	Gentianaceae	1	0.6	52	Amaryllidaceae	1	0.6
41	Equisetaceae	1	0.6	53	Amaranthaceae	1	0.6
42	Cuscutaceae	1	0.6	54	Alstroemeriaceae	1	0.6

The group A is characterized by plants widely distributed in the world, something that can be explained by the introduction of them during the conquest of the Americas. That they are common explains why they have been investigated so extensively. Noticeable is the fact that some of these plants are not used as medicinal plants in the Eastern cultures, indicating that some knowledge was developed after they were introduced. To this groups belong plants well known from their

commercial value, fruits and flowers, and many identified as weeds in agricultural crops, but they are not consider to be priority phytochemical targets in this investigation.

Groups B and C, however, were at the center of this research. A brief review about each species considering what sort of extract was studied (e.g essential oils), the main constituents and their biological activities was prepared. Where no specific compounds were studied we indicate what sort of extract was studied i. e. Essential oil (ESO), Oleoresin, alcoholic extract, etc. Group B contains 19 species of which 16 are in focus for at least one phytochemical report, the three remaining species didn't have any one.. It is important to note that biological activity was reported only for 10 plants in this group. Table 3 summarizes the results obtained from this group. Several of the studies reporting biological activity are based only of screening of crude extracts or essential oils, only in a few cases the active compounds had been identified. Most of those cases are report on new substances. Group C contains 31 species; only 12 of these are reported with some specific biologic activity. The most of the studies are related with studies of the essential oils. 17 species are only covered by one phytochemical report, describing a few compounds.

Group C contains 31 species, only 12 of these are reported with some specific biologic activity. The most of the studies are related with studies of the essential oils. 17 species are only covered by one phytochemical report, describing a few compounds. see table 4. 17 species have only one phytochemical report describing few compounds.

CONCLUSIONS

From a total of 168 species reported by the traditional medics from Apillapampa 16 % have been deeply studied, 10 % was moderately studied, 17 % was barely studied (less than 2 phytochemical related studies), and near the 45 % were not studied at all. Among the plants that have some studies (group B and C) only 46 % have shown to be subjected to some kind of biological activity screening.

It is clearly show in this study that there is a big unexplored field from medicinal plants from the Bolivian traditional medicine. Due the big diversity and importance of traditional medicine in Bolivia, more studies concerning traditional plants must carried on, the results found in this research indicated that plants showed biological activity in different fields and could be an important contribution to attenuation of health problems in Bolivia.

ACKNOWLEDGEMENTS

The authors are grateful to the Swedish International Development Agency (Sida) and its research division SAREC, for the economical support of this work.

Table 4. Group B Studied plants, description of different studies done.

	Specie	Studies	Main constituyents	Biological activity reported
1	xanthium spinosum	15	Atractyloside[4], sesquiterpene lactones [5 6 7 8 9], diterpene glycosides[10]	Antitumor, Antimicrobial, Toxic
2	Baccharis dracunculifolia	10	Cinnamic acids [11], flavonoids glycosides[12 13] ESO[14 15 16]	Cariogenic[17], trypanocidal [18]
3	cestrum parqui	10	Phenols [19]nor-isoprenoids[20], spirostanol [21], saponins [22], kaurene glycocides[23 24]	molluscicidal , toxic [25]
4	aloysia gratissima	8	ESO [26 27 28 29 30 31 32]	Nematicidal virucidal antimicrobial
5	solanum abutiloides	8	Sesquiterpenoids[33] , steroidal glycosides[34 35 36] cholestane glycosides [37 38 39], alkaloids[40]	anti-fungal , anti-herpes[41]
6	Apium Leptophyllum	8	hydroxybenzofuran Acid[42], volatil oil [43 44] , phenolics[45], furanocoumarin[46 47 48 49]	Antimicrobial
7	Satureja Boliviana	7	Phenols[50] ESO[51 52 53 54 55] terpenes[56], flavonoids	Gastic cytoprotection[57], anti-tumor,antiviral[58]
8	Baccharis genistelloides	6	diterpenoids[59 60], ESO[61 62], flavonoids	Anthi-arthritic[63], gastric cytoprotection, antiviral[64]
9	Zanthoxylum coco	5	Coumarin[65], pyranoquinoline [66] Alkaloids[67 68], Seed's oil[69 70]	
10	passiflora mollissima	4	Naringenin[71],Passifloricins[72] , alpha Pyrones, glycosidically bound Eugenol[73] Methyl salicylate, volatile constituyents[74]	
11	Schkuhria pinnata	4	Sesquiterpene lactones[75 76],terpenes[77],sterol[78], triterpenols	
12	Equisetum giganteum	3	Oleoresin[79] , crude extract[80 81]	no antibacterial, nerve growth factor related
13	rumex conglomeratus	2	Flavanones[82] Anthracene derivatives[83]	
14	ligaria cuneifolia	2	flavoniods[84], galactoside lectin[85]	cell growth regulators, inmunobiological
15	ullucus tuberosus	1	triterpenoid saponins[86]	hypoglycemic activity
16	Prosopis laevigata	1	Flavonoids[87]	
17	Bromus unioloides	0	No phytochemical research	
18	Anoda Cristata	0	No phytochemical research	
19	Nicotiana otophora	0	No phytochemical research	

Table 5. Group B Studied plants, description of different studies done.

	Specie	Studies	Main contituyents	Biological activity reported
1	*Mutisia acuminata*	4	Flavonoids[88], Coumarins[89], coumestan derivatives	Antimicrobial[90], no significant wound healing activity[91]
2	*Plazia daphnoides*	5	Caffeic acid esters[92],diterpenes[93],coumarin derivativesESO[94 95 96 97]	
3	*Ephedra americana*	2	Tannins[98], Ephedrine[99]	
4	*Dunalia brachyacantha*	3	sesquiterpenes[100], withanolides [101 102], flavanones	antiparasite, antibacterial,antifungal, trypanocidal
5	*Solanum tripartitum*	2	steroidal alkaloids[103 104]	tumor inhibitors
6	*Minthostachys andina*	3	ESO[105 106 107]	
7	*Chuquiraga parviflora*	2	Flavanoids[108 109]	
8	*Melilotus indicus*	2	benzo-1,2-pyrones[110], sterols[111]	
9	*Tagetes pusilla*	2	flavonoids[112], ESO[113]	antitumor, insecticidal,antiviral[114] ,antiinflamatory[115]
10	*Eryngium paniculatum*	3	ESO [116],terpene aldehyde [117]	carcer therapy[118]
11	*Colletia spinosissima*	3	seeds oil[119], triterpenoids[120], alkaloids[121]	
12	*Cortaderia rudiuscula*	1	Triterpene methyl esthers[122]	
13	*Lepechinia graveolens*	2	Phenolics[123], ESO[124]	Antioxidant activity
14	*Lycianthes lycioides*	1	crude extract[125]	cytotoxicity screening
15	*Caiophora canarinoides*	1	Seed oil[126], stearidonic acids, gama linoleic acid	
16	*Caiophora chuquitensis*	1	Xanthine[127], sweroside, rutin, shikimic acid, kaempferol 127	Atioxidant activity
17	*Salvia haenkei*	2	Clerodane diterpenoids [128], triterpenoids[129]	
18	*Hedeoma mandoniana*	2	ESO[130 131]	insecticidal activity
19	*Otholobium pubescens*	1	Bakuchiol[132]	antihyperglycemic activity
20	*Berberis boliviana*	1	Alkaloids[133]	hair loss treatment[134]
21	*Ambrosia arborescens*	1	herb suspensions[135], sesquiterpene lactones[136]	hypoglicemicand hyperinsulinemic effects
22	*Ophryosporus charua*	1	Benzofurans[137], ESO[138]	
23	*Proustia cuneifolia*	1	Coumarins[139 140]. guaianolides	
24	*Senecio pampeanus*	1	Alkaloids[141]	
25	*polylepis besseri*	1	ESO[142]	
26	*Gentiana Sedifolia*	1	Xanthones[143]	
27	*Tessaria fastigiata*	1	Sesquiterpenes[144], flavonoids	
28	*Senecio clivicolus*	1	terpene derivatives[145]	
29	*Flourensia riparia*	1	Sesquiterpene lactones[146], septuplinolide	
30	*Verbesina semidecurrens*	1	Eudesmane derivatives[147]	
31	*Mutisia orbignyana*	1	methylcoumarin[148]	

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