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Review

Mexican plants with hypoglycaemic effect used in the treatment of diabetes

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Abstract

Diabetes mellitus is a syndrome which affects more and more people in all countries over the world. In México, it is commonly treated with herbal extracts. Such treatment may be of considerable benefit especially during the early stages of the illness. In this review, we discuss species commonly used in México in the treatment of diabetes. A total of 306 species have records of a popular use in the treatment of this syndrome in México. Seven of these species – *Cecropia obtusifolia* Bertol. (Cecropiaceae), *Equisetum myriochaetum* Schlecht & Cham (Equisetaceae), *Acosmium panamense* (Benth.) Yacolev (Fabaceae), *Cucurbita ficifolia* Bouché (Cucurbitaceae), *Agarista mexicana* (Hemsl.) Judd. (Ericaeae), *Brickellia veronicaefolia* (Kunth) A. Gray (Asteraceae), *Parmentiera aculeata* (*Kunth*) *Seem.* (Bignoniaceae) – are discussed in greater detail, highlighting our current knowledge about these botanicals, but also the enormous gaps in our knowledge, most notably as it relates to the species' toxicology, the pharmacokinetics of its active constituents and their metabolism.

Keywords: Type 2 diabetes; Hypoglycaemic plants; México; Neotropics; Traditional medicine

Contents

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1. Introduction

It is well known that diabetes mellitus is the commonest endocrine disorder that, according to the World Health Organization (WHO, 2004), affects more than 176 million people world wide, in México the WHO estimates that the number of diabetic patients will increase from more than 2 million in 2002 to more than 6 million in 2030, which would imply that in a few decades México may have highest rate of diabetes in the world. According to the Mexican health services, in 2001 diabetes was the first cause of mortality among the Mexican population (SSA, 2004). Because of the complications linked to diabetes like heart disease, retinopathy, kidney disease, and neuropathy, it also is a common cause of chronic morbidity and disability among the working population.

The term diabetes mellitus describes a metabolic disorder of multiple aetiologies and is characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both. The causes of type 2 diabetes

are either insulin resistance with relative insulin deficiency or predominantly an insulin secretory defect with or with out insulin resistance (WHO, 1999).

From an ethnopharmacological perspective, it is important to understand that this disease is one at the interface of conventional biomedical and local (or traditional) treatment. In México, limited data is available but based on our field experience diabetic patients practically always use plants with or without biomedical medication. Normally, patients are diagnosed in one of the primary health care centres and the MDs in these centres normally also prescribe appropriate medication. However, once a diagnosis is made the patients often recur to either local healers or to vendors of herbal and other health care products. Thus this is a disease for which many of the 'traditional' treatments were in fact developed in the last decades by local healers. In USA, some plant based compounds as well as herbal remedies are used along with other medications. In some cases, patients used these treatments instead of conventional medications, and severe complications including increased hospitalizations, ketoacidosis, and acute hyperglycaemia occurred (Shane-Mc Whorter, 2001). In Germany, at least two products for the treatment of diabetes, based on Mexican medicinal plants are available: Hando, Nopal (opuntia sp.), manufactured by Hando Austria and Sucontral (Coplachi: Hintonia sp.) manufactured by Harras Pharma, Munich.

There have been many studies on hypoglycaemic plants and a great variety of compounds have been isolated (alkaloids, glycosides, terpenes, flavonoids, etc.), but the main bottleneck is the further development of such 'leads' into clinically useful medicines and especially phytomedicines or adequate nutritional supplements, which would be of direct benefits to patients. In this context, it is important to remember that the modern drug metformin (a bi**g**uanide) is a derivate of an active natural product, galegine a guanidine isolated from the plant *Galega officinalis* L., which was used in the medieval times to relieve the intense urination in diabetic people (Witters, 2001).

In this review we summarize information on plants with current information in the international literature and highlight the current state of ethnopharmacological, phytochemical and clinical research on some of the more widely used and better known species.

2. An overview of important sources of information on Mexican antidiabetic plants

Several valuable reviews on the ethnobotanical use of plants of México are available (Martínez, 1954; Díaz, 1976; Aguilar et al., 1994; Argueta, 1994; Aguilar and Xolalapa, 2002). Other data can be found in many of the ethnobotanical thesis or monographs on specific regions. For México, we have documented at least 306 species from 235 genera and 93 families used as hypoglycaemic agents (see Table 1). The most commonly mentioned families are: Asteraceae (47 sp.), Fabaceae, (27), Cactaceae (16), Solanaceae and Euphorbiaceae (10) and Laminaceae (9).

But in our own experience from field work in Guerrero (Andrade-Cetto, 1995), when a directed ethnobotanical study is performed looking only from hypoglycaemic plants instead of a broad study looking for all medicinal plants, this number is at least double. Therefore, we estimate that there are about 500 species used by Mexican people to treat type 2 diabetes.

Starting at the early 1990s, important pharmacological studies were conducted by Alarcón Aguilar and Román-Ramos (Alarcón-Aguilar et al., 1997, 1998, 2000a, 2000b, 2002a, 2002b; Román-Ramos et al., 1991, 2001). In the beginning, this group tested several plants for their pharmacological activity in temporarily hyperglycaemic rabbits. Hyperglycaemia was induced with a glucose charge; later on they use healthy and alloxan-diabetic mice. Normally, the plant was process in the traditional way and the water extract tested. The authors have not looked for bioactive compounds of these species, with the exception of a detailed report on the pharmacology and phytochemistry of *Psacalium* sp.

The group of Pérez-Gutiérrez et al. (1996, 1998a, 1998c, 2000a, 2000b, 2001), Pérez-Gutiérrez and Vargas (2001) and Pérez et al. (1984, 1992) normally look for the pharmacological activity in normal and alloxan diabetic mice and rats. The group isolated bioactive compounds from some of the species working with the chloroform extracts.

The group of Andrade-Cetto (Andrade-Cetto et al., 2000; Andrade-Cetto and Wiedenfeld, 2001, 2004, and Wiedenfeld et al., 2000, 2003) generally starts with their own field studies. Then the traditionally used extract (normally water or butanol) is tested on Streptozotocin diabetic rats, from the active extract the main compounds are isolated and tested in the animal model.

There are some clinical studies like the well known one by Frati-Munari et al. (1983, 1987, 1989a, 1989b, 1989c, 1990, 1991a, 1991b), Castaneda-Andrade et al. (1997), Acosta-Patino (2001) (Revilla-Monsalve et al., 2002), and (Herrera-Arellano et al., 2004). Acosta Patiño and Revilla associated with the above described groups.

Finally we have recompilations in which the authors describe some aspects of species with hypoglycaemic effects from México (Pérez-Gutiérrez et al., 1998b) or some Mexican plants as part of world wide studies (Marles and Farnsworth, 1995; Ernst, 1997; Lamba et al., 2000). The detailed reviews of Shane-Mc Whorter (2001) and Yeh et al. (2003) on clinical aspects of anti-diabetic plants include, for example, the commonly used *Momordica charantia* L. (originally from Asia) and *Opuntia* sp. (a native of México). These relatively well known studied species are excluded from this review. Also, "Matarique" *Psacalium decompositum* (*Gray*) *H.E. Robins & Brett*, is not reviewed here. Research and development activities on this botanical lead to a patent on some compounds present in the plant with hypoglycaemic proprieties A detailed review was conducted as part of the efforts to obtain a patent (Inman et al., 1998): "the novel hypoglycemically active eremophilanolide sesquiterpenes which can be

Table 1
Main plants reported in México as Hypoglycemic, the original table is from Andrade, 1995, the data were actualized and 40 species added from Aguilar and Xolalpa 2002, the correct botanical names were corroborated at Missouri Botanical Garden (2004)—TROPICOS

Scientific name	Common name	Family	Plant part used and preparation	Pharmacological STudies*	Phytochemical informat**
Abutilon lignosum (Cav.) D. Don	Sacxiu	Malvaceae	Root infusion		
Abutilon trisulcatum (Jacq.) Urban.	Tronadora	Malvaceae	Leaf boil		
Acacia retinodes Schltdl.	Mimosa	Fabaceae	Leaf boil		
Acourtia thurberi. (A. Gray) Reveal & R. M. King	Matarique	Asteraceae	Plant (aerial) infusion	Normal rabbits (+)	
Acrocomia mexicana Karw. ex Mart.	Coyol	Arecaceae	Root roasted, fruit raw	Alloxanic mice (+) Alloxanic mice (++) EtOH	Tetrahydropyrane, Coyolose
Agastache mexicana (Kunth) Lint et Epling	Toronjil	Lamiaceae	Plant (aerial) infusion		Essential oils
Agave atrovirens Karw. Ex Salm-Dyck	Maguey	Agavaceae	Steam macerated		Sapogeninns
Agave lecheguilla Torr.	Lechuguilla	Agavaceae	Steam macerated		
Agave salmiana Otto ex Salm-Dyck	Maguey	Agavaceae	Steam macerated		
Ageratina petiolaris Moc. & Sessé ex DC.	Hierba del ángel o Yolochichotl	Asteraceae	Plant (aerial) infusion		Terpens
Ageratum conyzoides L.	Hierba dulce	Asteraceae	Plant (aerial) infusion		Flavonoids, essential oils, terpens
Allionia choisyi Standl.	Hierba de la hormiga	Nyctaginaceae	Plant (aerial) infusion		
Allium cepa L.	Cebolla	Liliaceae	Bulbs raw		Sulfuric compounds
Alloispermum integrifolium (DC.) H. Rob.	Prodijiosa	Asteraceae	Plant (aerial) infusion		
Aloe barbadensis Mill.	Sábila	Liliaceae	Steam roasted, juice of the leaves	Normal rabbits (−)	Polysaccharides, flavonoids
Aloe vera (L.) Burm. F	Sábila	Liliaceae	Mixed with Nopal taken orally before meals	Normal mice (+)	Polysaccharides A B, flavonoids, terpens
Ambrosia artemisiifolia L.	Artemisa	Asteraceae	Plant (aerial) infusion		Sesquiterpen lactones
Anacardium occidentale L.	Marañon	Anacardiaceae	Bark infusion		
Ananas comosus (L.) Merr.	Piña	Bromeliaceae	Juice of the fruit		Monoterpenoids, Carotenoids, Lactones
Annona cherimola Mill.	Chirimoya	Annonaceae	Bark infusion		Isoquinolin Alkaloids
Annona glabra L.	Anona silvestre, palo de corcho	Annonaceae	Juice of the fruit root infusion		Diterpens, Alkaloids
Annona muricata L.	Guanabana	Annonaceae	Fruit raw		
Apodanthera buraeavi Cogn.	Pisto	Cucurbitaceae	Plant (aerial) infusion		
Aporocactus flagelliformis (L.) Lem.	Flor de junco	Cactaceae	Flowers infusion, steam infusion		
Arachis hypogaea L.	Cacahuate	Fabaceae	Seeds and oil		Sterols, flavonoids
Arceuthobium vaginatum (Humb. & Bonpl. ex Willd.) J. Presl	Injerto	Loranthaceae	Plant infusion		
Arctostaphylos pungens Kunth	Pingüica	Ericaceae	Leaves infusion, roots infusion		Tannins
Argemone mexicana L.	Chicalote, Cardo lechero.	Papaveraceae	Plant (aerial) infusion		Alkaloids, flavonoids
Argemone ochroleuca Sweet	Chicalote	Papaveraceae	Plant (aerial) infusion		Alkaloids
Argemone platyceras Link & Otto	Chicalote	Papaveraceae	Plant (aerial) infusion		
Aristolochia asclepiadifolia Brandegee	Guaco	Aristolochiaceae	Plant infusion EtOH		
Aristolochia malacophylla Standl.	Guaco	Aristolochiaceae	Flowers infusion		
Aristolochia sericea Benth.	Guaco	Aristolochiaceae	Steam infusion		

Table 1 (*Continued*)

Scientific name	Common name	Family	Plant part used and preparation	Pharmacological STudies*	Phytochemical informat**
Artemisia absinthium L.	Ajenjo	Asteraceae	Leaf boil		Sesquiterpen lactones, flavonoids
Artemisia ludoviciana Nutt.	Estafiate	Asteraceae	Plant (aerial) infusion		
Artemisia vulgaris L.	Ajenjo	Asteraceae	Leaf boil		Sesquiterpens flavonoids
Asclepias linaria Cav.	Romerillo	Asclepiadaceae	Plant (aerial) infusion		Sterols, triterpenoids
Barosma betulina Bartl. & H.L. Wendl.	Buchü	Rutaceae	Leaves infusion		
Bauhinia divaricata L.	Pata de vaca	Fabaceae	Leaf boil, flowers boil	Normal rabbits (+)	
Begonia heracleifolia Schltdl. & Cham.	Mano de león	Begoniaceae	Steam infusion		
Berberis moranensis Schult. & Schult. f.	Palo muerto	Berberidaceae	Bark infusion		Cucurbitacines
Beta vulgaris L.	Betabel	Chenopodiceae	Juice of the leaves		Alkaloids, flavonoids
Bidens aurea (Aiton) Sherff	Té de milpa	Asteraceae	Plant (aerial) infusion		Essential oils
Bidens leucantha (L.) Willd.	Rosilla	Asteraceae	Plant (aerial) infusion	Alloxanic mice (++)	
Bidens odorata Cav.	Aceitilla, Mosote blanco	Asteraceae	Plant (aerial) infusion		Flavonoids, triterpens
Bidens pilosa L.	Aceitilla	Asteraceae	Plant (aerial) infusion	Alloxanic mice (+)	Flavonoids, triterpens
Bocconia arborea S. Watson	Llora sangre	Papaveraceae	Leaves infusion		Alkaloids
Puemus boldus Molina J. A. Schultes & J. H. Schultes in J. J. Roemer & J. A. Schultes	Boldo	Monimiaceae	Plant (aerial) infusion		
Bouvardia ternifolia (Cav.) Schltdl.	Trompetilla	Rubiaceae	Leaves, steam infusion		Bouvardin
Brickellia cavanillesii (Cass.) A. Gray	Prodigiosa	Asteraceae	Plant (aerial) infusion	Normal rabbits (+)	Essential oils, brikelin
Brickellia squarrosa B.L. Rob. & Seaton	Amula	Asteraceae	Plant (aerial) infusion	Normal rabbits (+)	Flavonoids
Brosimum alicastrum Sw.	Ojite	Moraceae	Bark infusion		Benzoquinones
Buchnera pusilla Kunth	Chichibé	Scrophulariaceae	Bark infusion		
Buddleia stachyoides Cham. & Schltd/.	Hierba del perro	Loganiaceae	Leaves infusion		Flavonoids, alkaloids, essential oils
Buddleja Americana L.	Tepozán	Loganiaceae	Leaves infusion		Flavonoids, alkaloids
Buddleja cordata Kunth	Tepozán	Loganiaceae	Leaves infusion		Alkaloids
Bursera simaruba (L.) Sarg.	Cuajiote	Burseraceae	Bark infusion		Tannins
Byrsonima crassifolia (L.) Kunth	Nanche	Malpighiaceae	Fruit, bark infusion		Triterpenoids
Cacalia decomposita A. Gray	Matarique	Asteraceae	Root infusion	Alloxan Mice (++)	Alkaloids, polysaccharides
Cacalia peltata Kunth	Matarique	Asteraceae	Root infusion	Normal rabbits (++)	Polysaccharides
Calamintha macrostema Benth.	Tabaquillo	Lamiaceae	Root infusion	Alloxanic mice (+)	
Calea hypoleuca B.L. Rob. & Greenm.	Prodigiosa	Asteraceae	Plant (aerial) infusion		
Calea integrifolia (DC.) Hemsl.	Prodigiosa	Asteraceae	Stem, infusion		Sesquiterpen lactones
Calea zacatechichi Schltdl.	Prodigiosa	Asteracae	Leaves infusion	Normal rabbits (+)	
Calliandra anomala (Kunth) J.F. Macbr.	Cabello de ángel	Fabaceae	Leaves infusion		Triterpenoid saponins
Callicarpa acuminata Kunth	Xpuk'im	Verbenaceae	Root, infusion		
Capraria biflora L.	Sabadilla	Scrophulariaceae	Leaves infusion	Alloxanic mice (+)	Alkaloids, loiflorin
Carica papaya L.	Papaya	Caricaceae	Latex		Monoterpenoids
Carya Nutt.	Nogal	Juglandaceae	Leaves infusion		
Casimiroa edulis La Llave & Lex.	Zapote blanco	Rutaceae	Leaves infusion, bark infusion		Alkaloids, casimiroin, edulein, edulinin
Cassia fistula L	Caña Fístula	Fabaceae	Fruit		

Table 1 (*Continued*)

Scientific name	Common name	Family	Plant part used and preparation	Pharmacological STudies[*]	Phytochemical informat[**]
Cassia skinneri Benth.	Frijolillo	Fabaceae	Leaves infusion		
Cassia tomentosa L. f.	Retama cimarrona	Fabaceae	Leaves infusion		
Castela texana (T. & G.) Rose	Chaparro amargoso	Simaroubaceae	Bark infusion		Steroids
Castela tortuosa Liebm.	Venenilo	Simaroubaceae	Bark infusion		
Castilleja Mutis ex L. f.	Hierba del gato	Scrophulariaceae	Plant (aerial) infusion		
Catharanthus roseus (L.) G. Don	Vicaria	Apocinaceae	Root infusion		
Cecropia peltata L.	Guarambo	Cecropiaceae	Leaves infusion		
Ceiba pentandra (L.) Gaertn.	Ceiba, Pochote	Bombacaceae	Bark infusion		Essential oils
Centaurium brachycalyx Standl. & L.O. Williams	Tlanchalahua	Gentianaceae	Leaves infusion		
Centaurium calycosum (Buckley) Fernald	Tlanchalagua	Gentianaceae	Leaves infusion		
Chamaecrista hispidula (Vahl) H.S. Irwin & Barneby	Frijolillo	Fabaceae	Leaves infusion		
Chamaecrista hispidula (Vahl) H.S. Irwin & Barneby	Frijolillo	Fabaceae	Leaves infusion		
Chenopodium glaucum L.	Hierba del puerco	Chenopodiceae	Plant (aerial) infusion		
Chromolaena bigelovii (A. Gray) R.M. King & H. Rob	Ambula	Asteraceae	Plant (aerial) infusion		
Cirsium mexicanum DC.	Cardo santo	Asteraceae	Root infusion		
Cirsium rhaphilepis (Hemsl.) Petr.	Cardo santo	Asteraceae	Flower infusion		
Cissampelos pareira L.	Guaco	Menispermaceae	Root raw		Alkaloids, isoquinolin
Citrus aurantifolia (Christm.) Swingle	Limón	Rutaceae	Fruit		Essential oils, sesquiterpen lactones
Citrus limetta Risso	Lima	Rutaceae	Fruit		
Citrus sinensis (L.) Osbeck	Flor de azahar	Rutaceae	Ripe fruit infusion		Essential oils, flavonoids
Cnidoscolus aconitifolius (Mill.) I.M. Johnst.	Chaya	Euphorbiaceae	Leaves infusion		Polysaccharides
Cnidoscolus multilobus (Pax) I.M. Johnst.	Mala mujer	Euphorbiaceae	Leaves infusion		Triterpenoids, flavonoids, tannins
Cnidosculus chayamansa Mc Vaugh	Chayamansa	Euphorbiaceae	Leaves infusion		Flavonoids glycosides
Coix lacryma-jobi L.	Lágrima de San Pedro	Poaceae	Plant (aerial) infusion	Normal rabbits (+)	
Combretum farinosum Kunth	Bejuco de Carape	Combretaceae	Sap raw		
Conyza filaginoides (D C.) Hieron.	Simonillo	Asteraceae	Plant (aerial) infusion		Alkaloids, lenecin
Conyza gnaphalioides Kunth	Cimonillo, zacachichitl	Asteraceae	Leaves infusion		Terpens
Cordia elaeagnoides A. DC.	Cueramo	Boraginaceae	Bark infusion		Terpens
Cordia tinifolia Willd. Ex Roem. & Schult.	Palo mulato	Boraginaceae	Bark infusion		
Coriandrum sativum L.	Cilantro	Apiaceae	Plant (aerial) infusion		Coumarins, flavonoids, sesquiterpenoids, steroids
Costus mexicanus Liebm. ex Petersen	Caña de Jabalí	Zingiberaceae	Plant (aerial) infusion		
Costus rubber C. Wright ex Griseb.	Caña agria	Zingiberaceae	Plant (aerial) infusion		
Costus spicatus (Jacq.) Sw.	Caña de Jabalí	Zingiberaceae	Plant (aerial) infusion		
Crataegus mexicana Moc. & Sésse ex DC.	Tejocote	Rosaceae	Root infusion		
Crataegus pubescens (C. Presl) C. Presl	Tejocote	Rosaceae	Root infusion	Normal rabbits (++)	Tannins, flavonoids
Crotalaria acapulcensis Hook. & Arn.	Retama	Fabaceae	Leaves infusion		

Table 1 (*Continued*)

Scientific name	Common name	Family	Plant part used and preparation	Pharmacological STudies*	Phytochemical informat**
Croton draco Schltdl.	Sangre de Grado	Euphorbiaceae	Cortex infusion, latex		Diterpens
Croton torreyanus Müll Arg.	Salvia	Euphorbiaceae			
Cucurbita maxima Duchesne	Calabaza	Cucurbitaceae	Fruit juice		Sterols, flavonoids
Cucurbita mexicana Damm	Calabaza, Melón	Cucurbitaceae	Leaves infusion fruit juice	Normal rabbits (++)	
Cuscuta jalapensis Schltdl.	Sacapal	Convolvulaceae	Steam infusion		
Cyathea fulva (M. Martens & Galeotti) Fée	Árbol de la vida	Cyatheaceae	Root infusion		
Cyathea fulva (Martens & Galeotti) Fée.	Árbol de la vida	Filicaceae	Leaves infusion		
Cynara scolymus L.	Alcachofa	Asteraceae	Fruit infusion, flowers infusion		Flavonoids, sesquiterpen lactones, fenolic acids
Cynodon dactylon (L.) Pers.	Grama	Poaceae	Plant (aerial) infusion	Normal rabbits (+)	Flavonoids, terpens
Daucus carota L.	Zanahoria	Apiaceae	Root juice		Cumarines, flavonoids, essential oils, fenolic acids
Diospyros digyna Jacq.	Zapote negro	Ebenaceae	Fruit		
Dorstenia contrajerva L.	Contrayerba	Moraceae	Leaves bolied		Alkaloids, cardenolids
Dyssodia micropoides (DC.) Loes.	Hierba pelotazo	Asteraceae	Plant (aerial) infusion		
Elaphoglossum sp. Schott ex J. Sm.	Hierba del pastor	Lomariopsidaceae	Plant (aerial) infusion		
Equisetum giganteum L.	Limpia plata	Equisetaceae	Plant (aerial) infusion		Flavonoids
Equisetum hyemale L.	Cola de caballo	Equisetaceae	Plant (aerial) infusion		Flavonoids, alkaloids
Eriobotrya japonica (Thunb.) Lindll.	Níspero	Rosaceae	Leaves infusion, flowers infusion	Normal rabbits (—)	Sesquiterpens, flavonoids
Eucalyptus globules Labill	Eucalipto	Myrtaceae	Leaves infusion	Alloxanic mice (+)	Flavonoids, terpens
Euphorbia maculata L.	Hierba de la Golondrina	Euphorbiaceae	Leaves infusion		
Euphorbia prostrata Aiton	Hierba de la Golondrina	Euphorbiaceae	Leaves infusion		Flavonoids
Eysenhardtia polystachya (Ortega) Sarg.	Palo dulce	Fabaceae	Plant (aerial) infusion, bark infusion	Alloxanic mice (+)	Flavonoids, triterpens
Foeniculum vulgare Mill.	Hinojo	Apiaceae	Plant (aerial) infusion		Essential oils, flavonoids
Fouquieria splendens Engelm.	Albarda	Fouquieriaceae	Leaves infusion		
Fraxinus alba Marshall	Fresno	Oleaceae	Leaves infusion bark infusion		
Gnaphalium oxyphyllum DC.	Gordolobo	Asteraceae			Diterpens, flavonoids
Guaiacum coulteri A. Gray	Guayacan	Zygophyllaceae	Bark infusion		Alkaloids
Guaiacum sanctum L	Guayacan	Zygophyilaceae	Bark infusion		
Guardiola angustifolia (A. Gray ex S. Watson) B.L. Rob.	Chintuza	Asteraceae			
Guardiola tulocarpus A. Gray	Chintuza	Asteraceae	Leaves infusion		
Guazuma ulmifolia Lam.	Guázima	Sterculiaceae	Bark infusion		Alkaloids, tannins
Haemahtoxylon brasiletto H. Karst.	Palo Brazil	Fabaceae	Bark infusion		
Hamelia patens Jacq.	Balletilla	Rubiaceae	Leaves infusion		Tannins
Haplopappus venetus (Kunth) S.F. Blake	Xapulli	Asteraceae	Plant (aerial) infusion		
Hechtia melanocarpa L. B. Sm.	Maguey agrio	Bromeliaceae	Steam raw		Flavonoids, alkaloids
Heterotheca inuloides Cass.	Arnica	Asteraceae	Leaves infusion		Flavonoids, essential oils
Hibiscus rosa-sinensis L.	Tulipán	Malvaceae	Plant (aerial) infusion		Sterols, flavonoids
Hidalgoa ternata La Llave	Mozote de monte	Asteraceae	Plant (aerial) infusion		
Hintonia latiflora (Sesse & Moc. ex DC.) Bullock	Copalquin, Cáscara sagrada.	Rubiaceae	Bark infusion	Alloxanic mice (++)	Neoflavonoid, coutareagenin.

Table 1 (*Continued*)

Scientific name	Common name	Family	Plant part used and preparation	Pharmacological STudies[*]	Phytochemical informat[**]
Hippocratea excelsa Kunth	Cancerina	Hippocrateaceae	Root infusion		Sesquiterpens
Ipomoea starts Cav.	Tumba vaquero	Convolvulaceae	Plant (aerial) infusion		Essential oils
Jatropha dioica Cerv.	Sangre de grado	Euphorbiaceae	Root infusion		
Jatropha elbae J. Jiménez Ram.	Sangre de grado	Euphorbiaceae	Bark infusion		Terpens, flavonoids
Juliania adstringens (Schltdl.) Schltdl.	Cuachalalate	Julianiaceae	Bark infusion		Triterpens
Justicia spicigera Scheltdl	Muicle	Acanthaceae	Leaves infusion		Flavonoids
Kalanchoe pinnata (Lam.) Pers.	Tronador	Crassulaceae	Plant (aerial) infusion		Flavonoids
Karwinskia humboldtiana (Willd. ex Roem. & Schult.) Zucc.	Tullidora	Rhamnaceae	Leaves infusion		
Kohleria sp. Regel	Tlanchichinoli	Gesneriaceae	Leaves infusion		Triterpens
Larrea tridentata (Sessé & Moc. ex DC.) Coville	Gobernadora	Zygophylaceae	Plant (aerial) infusion		Terpens, lignans
Lepechinia caulescens (Ortega) Epling	Bretónica	Lamiaceae	Leaves infusion	Alloxanic mice (++)	Terpens
Lepidium virginicum L.	Lentejilla	Brassicaeae	Leaves infusion		
Leucaena leucocephala (Lam.) de Wit	Guaje	Fabaceae	Seed raw		Tannins
Leucophyllum texanum Benth.	Cenicillo	Scrophulariaceae	Plant (aerial) infusion		
Ligusticum porteri J.M. Coult. & Rose	Raíz de cochino	Apiaceae	Root infusion		Essential oils
Ligustrum japonicum Thunb.	Fresno	Oleaceae	Leaves infusion		
Loeselia coccinea (Cav.) G. Don	Hoja de la virgen	Polemoniaceae	Leaves infusion		Alkaloids, saponins
Loeselia mexicana (Lam.) Brand	Hierba de la virgen.	Polemoniaceae	Leaves infusion	Alloxanic mice (+)	Alkaloids, essential oils
Lonchocarpus cruentus Lundell	Guayacán	Fabaceae	Bark infusion		
Lopezia racemosa Cav.	Perilla	Onagraceae	Plant (aerial) infusion		
Lophocereus schottii (Engelm.) Britton & Rose	Muso	Cactaceae	Steam infusion		Alkaloids
Lysiloma acapulcense (Kunth.) Benth	Tepehuaje	Fabaceae	Leaves infusion, bark infusion		Tannins
Malmea depresa (Baillon) Fries	Elemuy	Anonaceae	Root infusion		Flavonoids
Malvastrum coromandelianum (L.) Garcke	Marvavisco	Malvaceae	Leaves infusion		Tannins
Mangifera indica L.	Mango	Anacardiaceae	Bark infusion leaves infusion		Flavonoids, essential oils, terpens
Marrubium vulgare L.	Marrubio	Lamiaceae	Leaves infusion, root infusion	Normal rabbits (++)	Terpens, flavonoids
Melothria pendula L.	Sandiita	Cucurbitaceae	Plant (aerial) infusion		
Mentha piperita L.	Hierbabuena	Lamiaceae	Leaves infusion		Essential oils, terpens, flavonoids
Mentha rotundifolia (L.) Huds.	Mostranza	Lamniaceae	Leaves infusion		Essential oils, terpens
Mentha suaveolens Ehrh.	Mastranzo	Lamiaceae	Leaves infusion		
Mimosa zygophylla Benth.	Gatuño	Fabaceae	Leaves infusion		
Mirabilis jalapa L.	Maravilla	Nyctaginaceae	Plant (aerial) infusion		Triterpens, flavonoids
Momordica charantia L.	Cundeamor,	Cucurbitaceae	Leaves infusion		Terpens, steroids, flavonoids
Morus nigra L.	Moral negro	Moraceae	Leaves infusion		
Musa sapientum L.	Flor de plátano	Musaceae	Root infusion		
Nasturtium officinale R. Br.	Berro	Brassicaeae	Plant (aerial) infusion		Flavonoids, alkaloids, terpens
Nopalea cochenillifera (L.) Salm-Dyck	Nopal	Cactaceae	Steam raw		

Table 1 (*Continued*)

Scientific name	Common name	Family	Plant part used and preparation	Pharmacological STudies[*]	Phytochemical informat[**]
Nopalea inaperta Schott ex Griffiths.	Nopal	Cactaceae	Steam raw		
Olea europaea L.	Hierba de oliva	Oleaceae	Leaves infusion		Alkaloids, flavonoids, terpens
Opuntia atropes Rose	Nopal bianco	Cactaceae	Steam raw		
Opuntia ficus-indica (L.) Mill.	Nopal	Cactaceae	Steam raw		Alkaloids, flavonoids
Opuntia fulgida Engelm.	Choya	Cactaceae	Steam raw		
Opuntia guilanchi Griffiths	Nopal blanco	Cactaceae	Steam raw		
Opuntia imbricata (Haw) DC.	Xoconostle	Cactaceae	Steam raw, fruit		
Opuntia leucotricha DC.	Duraznillo	Cactaceae	Steam		
Opuntia megacantha Salm-Dyck	Nopal blanco	Cactaceae	Steam raw		
Opuntia streptacantha Lem	Nopal	Cactaceae	Steam raw	Normal rabbits (+)	
Pachira aquatica Aubl.	Zapote de agua	Bombacaceae	Bark infusion		
Pachycereus marginatus (DC.) Britton & Rose	Organo, Sahuaro	Cactaceae	Steam raw		
Pachycereus pringlei (S. Watson) Britton & Rose	Cardón	Cactaceae	Steam raw		
Packera candidissima (Greene) W.A. Weber & Á. Löve	Lechugilla	Asteraceae	Plant (aerial) infusion		
Parathesis lenticellata Lundell	Chagalapoli	Myrsinaceae	Leaves infusion		
Parkinsonia aculeata L.	Bagote	Fabaceae	Leaves infusion		Flavonoids, triterpens
Parthenium hysterophorus L	Escobilla	Asteraceae	Plant (aerial) infusion		Alkaloids, partenin
Pavonia schiedeana Steud	Cadillo	Malvaceae	Leaves infusion	Normal rabbits (−)	Tannins
Persea americana Mill	Aguacate	Lauraceae	Leaves infusion		Sterols, flavonoids
Petroselinum crispum (Mill.) Nyman ex A.W. Hill	Perejil	Apiaceae	Plant (aerial) infusion		Essential oils, flavonoids
Phaseolus vulgaris L.	Fríjol	Fabaceae	Fruit infusion	Normal rabbits (+)	Essential oils, flavonoids, alkaloids
Phlebodium aureum (L.) J. Sm.	Calahuala	Polypodiaceae	Root infusion		Steroids
Phoradendron bolleanum (Seem.) Eichler	Injerto	Viscaceae	Plant (aerial) infusion		
Phoradendron tomentosum (DC.) Engelm. ex A. Gray	Muicle	Viscaceae	Plant (aerial) infusion		Phoratoxins
Phragmites australis (Cav.) Trin. ex Steud.	Carrizo	Poaceae	Plant (aerial) infusion		
Physalis coztomatl Dunal	Costomate	Solanaceae	Leaves infusion		
Physalis philadelphica Lam.	Tomate	Solanaceae	Fruit roasted	Normal rabbits (−)	
Piper auritum Kunth	Acoyo	Piperaceae	Leaves infusion		Terpens, flavonoids, essential oils
Piper hispidum Sw.	Cordoncillo	Piperaceae	Leaves infusion		
Piper sanctum (Miq.) Schltdl. ex C. DC.	Hierba Santa	Piperaceae	Leaves infusion		Essential oils, alkaloids
Piper schiedeanum Steud.	Tlaxalisnuat	Piperaceae	Leaves infusion		
Pithecellobium dulce (Roxb.) Benth.	Guamúchil	Fabaceae	Bark infusion		
Plantago australis Lam.	Gusanillo	Plantaginaceae	Plant (aerial) infusion		Lignans
Plantago major L.	Llante	Plantaginaceae	Plant infusion		Flavonoids, terpens
Plumbago scandens L.	Plumbago	Plumbaginaceae	w/i		Flavonoids
Plumeria rubra L.	Flor de mayo	Apocynaceae	Flowers infusion		
Polygonum acre Lam.	Sanguinaria	Polygonaceae	Leaves infusion		
Populus alba L.	Abedúl	Salicaceae	Leaves infusion		

Table 1 (*Continued*)

Scientific name	Common name	Family	Plant part used and preparation	Pharmacological STudies[*]	Phytochemical informat[**]
Porophyllum punctatum (Mill.) S.F. Blake	Piojillo	Asteraceae	Flowers infusion		
Portulaca denudata Poelln.	Verdolaga	Portulacaceae	Plant (aerial) infusion		
Portulaca oleracea L.	Verdolaga	Portulacaceae	Plant (aerial) infusion		Alkaloids, terpens
Pouteria hypoglauca (Standl.) Baehni	Baehni	Sapotaceae	Leaves infusion		
Prosopis juliflora (Sw.) DC.	Mezquite	Fabaceae	Fruit raw		
Prunus serotina subsp. capuli (Cav.) McVaugh	Capulín	Rosaceae	Fruit infusion		Terpens
Psacalium sinuatum (Cerv.) H. Rob. & Brettell	Matarique	Asteraceae	Root infusion		
Pseudosmodingium pemiciosum (Kunth) Engl.	Cuajilote	Anacardiaceae	Root infusion bark infusion		
Psidium guajava L.	Guayaba	Myrtaceae	Fruit		Terpens, flavonoids
Psidium yucatanense Lundell	Pach	Myrtaceae	Bark infusion		
Psittacanthus calyculatus (DC.) G. Don	Muérdago	Loranthaceae	Plant infusion, flowers infusion	Alloxanic mice (++)	
Quassia amara L.	Cuasia	Simaroubaceae	Leaves infusion		Alkaloids, terpens
Quercus acutifolia Neé	Encino	Fagaceae	Bark infusion		Terpens, flavonoids
Quercus rugosa Neé	Encino	Fagaceae	Bark infusion		
Randia echinocarpa Moc. & Sessé ex DC.	Grangel	Grangel	Leaves infusion		
Randia echinocarpa Moc. & Sessé ex DC.	Granjil	Rubiaceae	Fruit		
Raphanus sativus L.	Rábano	Brassicaceae	Root infusion		
Rhipsalis baccifera (J.S. Muell.) Steam	Niguilla	Cactaceae	Stem infusion, fruit raw		
Rhizophora mangle L.	Mangle	Rhizophoraceae	Bark infusion		Tannins
Ricinus communis L.	Huiguerilla	Euphorbiaceae	Leaves infusion		Flavonoids, terpens
Rosa centifolia L.	Rosa de castilla	Rosaceae	Leaves infusion		
Rubus adenotrichus Schltdl.	Zarzamora	Rosaceae	Leaves infusion		
Russelia equisetiformis Schltdl. & Cham.	Cola de caballo	Scrophulariaceae	Plant (aerial) infusion		
Salix taxifolia Kunth	Taray	Salicaceae	Steam infusion		
Salpianthus arenarius Humb. & Bonpl.	Catarinita	Nyctaginaceae.	Leaves infusion	Normal rabbits (++)	
Salvia leucantha Cav.	Salvia morada	Lamiaceae	Plant (aerial) infusion		Terpens
Samvitalia procumbens Lam.	Ojo de gallo	Asteraceae	Plant (aerial) infusion		Terpens
Saurauia pringlei Rose	Picon	Actnidaceae	Leaves infusion		
Sechium edule (Jacq.) Sw.	Chayote	Cucurbitaceae	Fruit raw		Flavonoids
Sedum dendroideum Moc. & Sessé ex DC.	Siempreviva	Crassulaceae	Plant (aerial) infusion		Sedoheoptulose
Sedum moranense HBK.	Siempreviva	Crassulaceae	Plant (aerial) infusion		
Sedum praealtum A. DC.	Siempreviva	Crassulaceae	Leaves infusion		
Selaginella lepidophylla (Hook. & Grev.) *Spring*	Doradilla	Selaginellaceae	Plant (aerial) infusion		Essential oils
Selaginella pallescens (C. Presl) Spring	Flor de piedra	Sellaginacae	Plant (aerial) infusion		
Selloa plantaginea Kunth	Diente de elef.ante	Asteraceae	Plant (aerial) infusion		
Senecio albo-lutescens Sch. Bip.	Matarique	Asteraceae	Root infusion		
Senecio palmeri A. Gray	Matarique	Asteraceae	Root infusion		
Senecio peltiferus Hemsl.	Matarique	Asteraceae	Root infusion		
Senna multiglandulosa (Jacq.) H.S. Irwin & Barneby	Retama china	Fabaceae	Leaves infusion		

Table 1 (*Continued*)

Scientific name	Common name	Family	Plant part used and preparation	Pharmacological STudies*	Phytochemical informat**
Senna obtusifolia L. (L.) H.S. Irwin & Barneby	Pa xojk	Fabaceae	Leaves infusion		Antraquinones, emodin
Senna occidentalis (L.) Link	Frijolillo	Fabaceae	Root infusion		Flavonoids, sterols
Serjania racemosa Schumach.	Bejuco tres en uno.	Sapindaceae	Plant (aerial) infusion		
Serjania triquetra Radlk.	Bejuco de tres C.	Salicaceae	Bark infusion		
Simira sp. Aubl	Quina roja, cáscara sagrada	Rubiaceae	Bark infusion		
Smilax aristolochiifolia Mill.	Zarzaparrilla	Similicaceae	Root infusion		Sapogenins
Solandra nitida Zuccagni	Flor de guayacán	Solanaceae	Flower infusion		
Solanum americanum Mill.	Hierba mora	Solanaceae	Plant (aerial) infusion		Alkaloids, solanin
Solanum brevistylum Wittm	Malabar	Solanaceae	Plant (aerial) infusion		
Solanum diversifolium Dunal	Malabar	Solanaceae	Leaves infusion	Normal rabbit (++)	
Solanum nigrescens M. Martens & Galeotti	Hierba mora	Solanaceae	Plant (aerial) infusion		
Solanum rostratum Dunal	Duraznillo	Solanaceae	Plant (aerial) infusion		
Solanum torvum Sw.	Berenjena	Solanaceae	Root infusion		
Solanum verbascifolium C.B. Wright	Berenjena	Solaneceae	Plant (aerial) infusion		Steroidal, alkaloids
Sonchus oleraceus L.	Lechuguilla	Asteraceae	Leaves infusion		Flavonoids
Spartium junceum L.	Retama	Fabaceae	Leaves infusion		
Sphaeralcea angustifolia (Cav.) G. Don	Hierba del negro	Malvaceae	Plant (aerial) infusion		
Stachytarpheta jamaicensis (L.) *Vahl*	Verbena	Verbenaceae	Plant (aerial) infusion		Terpens
Stenocereus marginatus (DC.) Berger & Buxb	Organo de Zopilote	Cactaceae	Steam roasted		
Struthanthus densiflorus (Benth.) Standl.	Injerto	Loranthaceae	Leaves infusion		
Swietenia humilis Zucc.	Zopilote	Meliaceae.	Seed raw		
Tagetes erecta L.	Cempasuchil o Flor de muerto,	Asteraceae	Plant (aerial) infusion		Terpens, essential oils
Tamarindus indica L.	Tamarindo	Fabaceae	Pulp of fruit raw		Flavonoids
Taraxacum qfficinale Weber ex F.H. Wigg.	Diente de león	Asteraceae	Leaves infusion		Terpens
Taxodium mucronatum Ten.	Ahuehuete	Taxodiaceae	Leaves infusion		Flavonoids
Tecoma starts (L.) Juss. ex Kunth	Tronadora	Bignoniaceae	Leaves infusion, plant infusion plant infusion	Alloxanic mice (++) Normal Dogs (++)	Alkaloids, terpens
Terminalia catappa L.	Castaño	Combretaceae	Fuit		
Teucrium cubense Jacq.	Agrimonia	Lamiaceae	Leaves infusion	Normal rabbits (+)	
Thriallis glauca (Cav.) Kuntze	Amargoso	Malphigiaceae	Root infusion		Flavonoids, terpens
Tillandsia usneoides (L.) L.	Heno	Bromeliaceae	Plant (aerial) infusion	Alloxanic mice (++)	Flavonoids
Tournefortia hirsutissima L.	Lagrima de San Pedro.	Boraginaceae	Steam infusion		
Tournefortia petiolaris DC.	Lagrima de San Pedro.	Boraginaceae	Steam infusion		
Tradescantia pendula (*Schnizl.*) D.R. Hunt	Comellina	Commelinaceae	Leaves infusion		Flavonoids
Trigonella foenum-graecum L.	Fenogreco	Fabaceae	w/i		
Tropaeolum majus L.	Mastuerzo	Tropaeoleaceae	Leaves infusion		
Turnera diffusa Willd ex Schult.	Damiana.	Turneraceae	Leaves infusion		Flavonoids, terpens
Urtica dioica L.	Ortiga	Urticaceae	Plant (aerial) infusion	Normal rabbits (–)	Flavonoids, coumarins
Urtica mexicana Liebm.	Ortiga	Urticaceae	Leaves infusion		

Table 1 (*Continued*)

Scientific name	Common name	Family	Plant part used and preparation	Pharmacological STudies*	Phytochemical informat**
Valeriana edulis Nutt. ex Torr. & A. Gray	Valeriana	Valerianaceae	Root infusion		
Valeriana procera Kunth	Valeriana	Valerianaceae	Root infusion	Alloxanic mice (−)	
Verbesina crocata (Cav.) Less.	Capitaneja	Asteraceae	Leaves infusion	Alloxanic mice (+)	
Verbesina persicifolia DC.	Huichin	Asteraceae	Plant (aerial) infusion	Alloxanic mice (+)	Sesquiterpens
Zaluzania angusta (Lag.) Sch. Bip.	Limpia tuna	Asteraceae	Root infusion		
Zantoxylum fagara L.	Tankasché	Rutaceae	Leaves infusion		Alkaloids
Zea mays h.	Pelos de elote	Poaceae	Fruit infusion		
Zexmenia gnaphalioides A. Gray	Peonia	Asteraceae	Root infusion		
Zizyphus acuminate Benth	Corongoro, amol	Rhamnaceae	Plant (aerial) infusion		

* In the Animal studies +, indicates activity and the level of it, while—mean no observed activity for the tested extract.
** The phytochemical information, refers about the reports for the plant no the active compounds.

isolated from *Psacalium* spp., processes for obtaining the novel eremophilanolide sesquiterpenes and methods for their use as hypoglycemic agents, for example, in the treatment of diabetes." Sadly, Mexicans have had no say in developing this patent on a Mexican plant.

Instead we review the current information of some lesser known plants commonly used in México to treat type 2 diabetes and summarise and discuss ethnobotanical, pharmacognostical, phytochemical, pharmacological and clinical data for the main species reported as hypoglycaemic in México (Table 1).

3. Ethnopharmacology of commonly used antidiabetic plants in México

Seven species used throughout México, reported in the international literature with pharmacological and phytochemical studies are discussed in greater detail and their potential for developing phytomedicines with a validated profile of activity and demonstrated safety profile is analysed (Table 2).

3.1. *Cecropia obtusifolia Bertol. (Cecropiaceae)*

The hypoglycaemic effect of this plant sold on several markets as a treatment for type 2 diabetes is well known in México, DF (Andrade-Cetto, 1999) and it is also known from many ethnobotanical collections in rural lowland areas (e.g. Heinrich, 1989).

3.1.1. *Botanical description*

A monopodic tree 20 m tall, growing in secondary vegetation in the tropical rain forest. This tree has a tall, straight, hollow trunk and a stratified treetop with few large branches growing horizontally from the trunk. The leaves are in a spiral disposition located at the top of the branches and are simple, peltate or deeply palmate, with a deep green colour in the upper face and grey at the lower surface. It is a fast-growing pioneer tree from tropical America, the hollow septate twigs are inhabited by ants (Pennington and Sarukhán, 1998).

3.1.2. *Distribution*

It is widespread in México, along both coasts, from Tamaulipas and San Luis Potosi to Tabasco on the Gulf of México, and from Sinaloa to Chiapas on the Pacific side. It is, in fact, a weedy species, which would presumably be relatively easy to grow on a larger scale or to harvest it sustainably by collecting material in the first few years after a *milpa* (corn field) has been given up.

3.1.3. *Ethnobotany*

Traditionally the dry leaves (15 g) are boiled in water (500 ml), the resulting infusion is cooled in the pot, then filtrated and drunk as "agua de uso". The cold infusion is consumed over the day or when the people have thirst. The use is reported from the following Mexican states, Hidalgo, Guerrero, Veracruz, Yucatan, Campeche, Tabasco, Edo. de México, Oaxaca and Chiapas. The traditional names include "Guarumbo", "Chancarro", "Hormiguillo", "Chiflon" and "Koochlé" among others.

3.1.4. *Main constituents*

The following constituents have been reported: β-sitosterol, stigmasterol, 4-ethyl-5-(*n*-3valeroil)-6-hexahydrocoumarin and 1-(2-methyl-1-nonen-8-il)-aziridine (Argueta, 1994). The type of extract for the isolated compounds has not been specified. From the butanolic extract Andrade-Cetto and Wiedenfeld (2001) isolated chlorogenic acid and isoorientin (Fig. 1 compounds **1** and **2**). The isolated compounds are also found in the medicinal tea.

3.1.5. *Pharmacology*

A hypoglycaemic effect of the water extract was demonstrated in alloxan diabetic mice (Pérez et al., 1984), in hyperglycaemic rabbits (Román-Ramos et al., 1991) and in

Table 2
Overview on antidiabetic effects of the seven species reviewed and commonly used in México (for references see text)

Botanical species	*Cecropia obtusifolia*	*Equisetum myriochaetum*	*Acosmium panamense*	*Cucurbita ficifolia*	*Agarista mexicana*	*Brickellia veronicaefolia*	*Parmentiera aculeata*
Animal model	Streptozotocin diabetic rats.	Streptozotocin diabetic rats	Streptozotocin diabetic rats	Hyperglycaemic rabbits Alloxan mice and rats	Normal and alloxan mice and rats	Normal and alloxan mice	Normal and alloxan mice
Clinical studies	In progress	In humans, positive	None	In humans, positive	None	None	None
Bioactive compounds	Chlorogenic acid (1), isoorientin (2)	Kaempferol-3-*O*-sophoroside, kaempferol-3,7-di-*O*-β-glucoside, caffeoyl-methylate-4-β-glucopuranoside kaempferol-3-*O*-sophoroside-4′-*O*-β-glucoside (3)	Caffeic acid desmethyl yangonine its $O^{4'}$-mono and di(1–6) glucoside (4 and 5)	Unknown	12-ursene 23,24 dimethyl 1-24-ethyl-sigmast-25-ene (6 and 7)	5,7,3′-trihydroxy-3,6,4′-trimethoxy flavone (8)	Lactucin-8-*O*-methylacrylate

Streptozotocin diabetic rats (Andrade-Cetto et al., 2000). Pérez-Guerrero et al. (2001) performed several pharmacological tests in male Swiss albino mice and concluded that the water extract of the leaves has low toxicity, a substantial effect as a central depressor, anti-inflammatory and analgesic effects. The report of Pérez et al. (1984) shows activity after 5 h of intraperitonal and oral administration of the aqueous extract (obtained from 50 g leaves boiled in 250 ml distilled water). This study does not give more details about the effects between time 0 and 5 h. Also, a proper positive control like glibenclamide is missing. There is no statistical evaluation of the data and the dose administered to each animal is not mentioned. The study by Román-Ramos et al. (1991) does not use a proper diabetic animal model (Versphol, 2002). Instead, it was conducted in healthy rabbits obtaining a glucose tolerance curve. The effect of the aqueous extract of 132 g leaves boiled in 1 l water and administering the infusion (4 ml/kg) using a gastric tube showed a significant hypoglycaemic effect at 60 min after the administration of the extract, and showed no activity after 4 and 5 h. Since the amount of dry extract administered was not measured in either study, the actual doses are missing. Also, in the study performed by Pérez et al. the reported activity is after 300 min (5 h) and Roman-Ramos et al. report no activity at this time.

In the study by Andrade-Cetto and Wiedenfeld (2001) in Streptozotocin diabetic rats, a positive and an untreated control was used, the water and butanolic extracts as well as the isolated compounds were tested, the hypoglycaemic effect is observed from 60 to 180 min for all the tested samples, with statistical significance. However, according to Versphol (2002) the animal model resembles more type I diabetes than type 2, while Islas-Andrade et al. (2000) provided evidence that using this model in a proper way diabetes type 2 can be mimicked.

Herrera-Arellano et al. (2004) performed a study on diabetic type 2 people, they conclude that the plant has a significant hypoglicemic effect after 21 days of oral administration, of 3 g/day of the plant. The Cecropia group was also treated with glibenclamide at different doses, and no proper controls were used, so there is no point of comparison, and the effect can not be only attributed to the extract. The authors argue that the plant was given in a similar way as the traditional preparation, but the traditional preparation takes between 12 and 15 g plant/day.

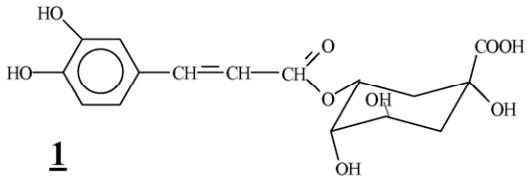
3.1.6. Possible mechanism of action

Chlorogenic acid was identified as a specific inhibitor of the glucose-6-phosphate translocase component (Gl-6-P translocase) in microsomes of rat liver (Hemmerle et al., 1997). Simultaneous targeting of gluconeogenesis and glycogenolysis with an inhibitor of Gl-6-P translocase would result in a reduction of hepatic glucose production. The action of chlorogenic acid may well explain the hypoglycaemic effect observed by Pérez et al. (1984). The hypoglycaemic effect observed in mice after 5 h of experiment may be due to a lack of hepatic glucose production resulting in a hypogly-

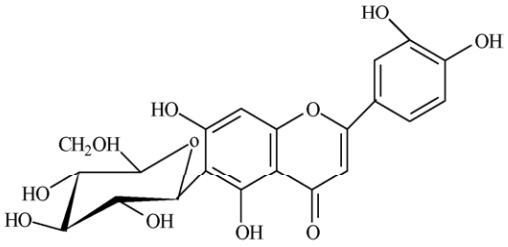
caemic state. This would have been caused by the liver not providing glucose due to the action of cholorogenic acid during the fasting of the animals. In the work by Román-Ramos et al. (1991), the animals were not fasted and they received an oral glucose charge at times 0 and 60 min at a dose of 2 g/kg. The authors did not observe any hypoglycaemic effect after 5 h, they argued that with this animal model glycaemia reaches basic values within 300 min. If the basic glycaemic value is reached at 300 min then the hepatic production of glucose has not been trigger, and there was no hypoglycaemic effect observed, and of course, no action of the cholorogenic acid.

The other compound isolated by Andrade-Cetto and Wiedenfeld (2001), isoorientin, had previously been tested by Afifi et al. (1999). They showed that the compound caused concentration-dependent inhibition of the amplitude and frequency of the phasic contractions of the rat and guinea-pig uterus but did not affect the isolated aorta, ileum or trachea. Deliorman-Orhan et al. (2003) tested the hepatoprotective activity of *Gentiana olivieri* and conclude that the effect "might possibly [be] due to the potent antioxidant activity of isoorientin". The antioxidant effect of plants used in diabetes treatment was shown by Letitia et al., 2002. According to these authors, the benefits of antioxidants in the prevention of the complications of diabetes supports and validates the use of the traditional medicine. Antioxidants are important in preventing diabetes, with low levels of plasma antioxidants implicated as a risk factor for the development of the disease,

Cecropia obtusifolia

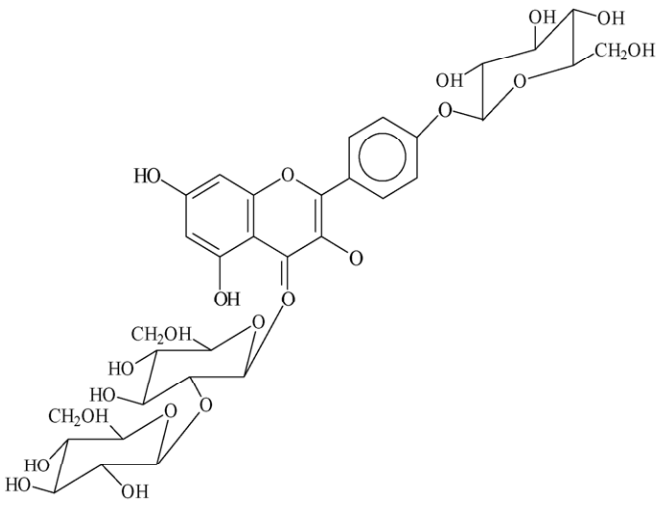


1



2

Equisetum myriochaetum



3

Fig. 1. Natural products with documented hypoglycaemic effects from the species discussed in detail in this review.

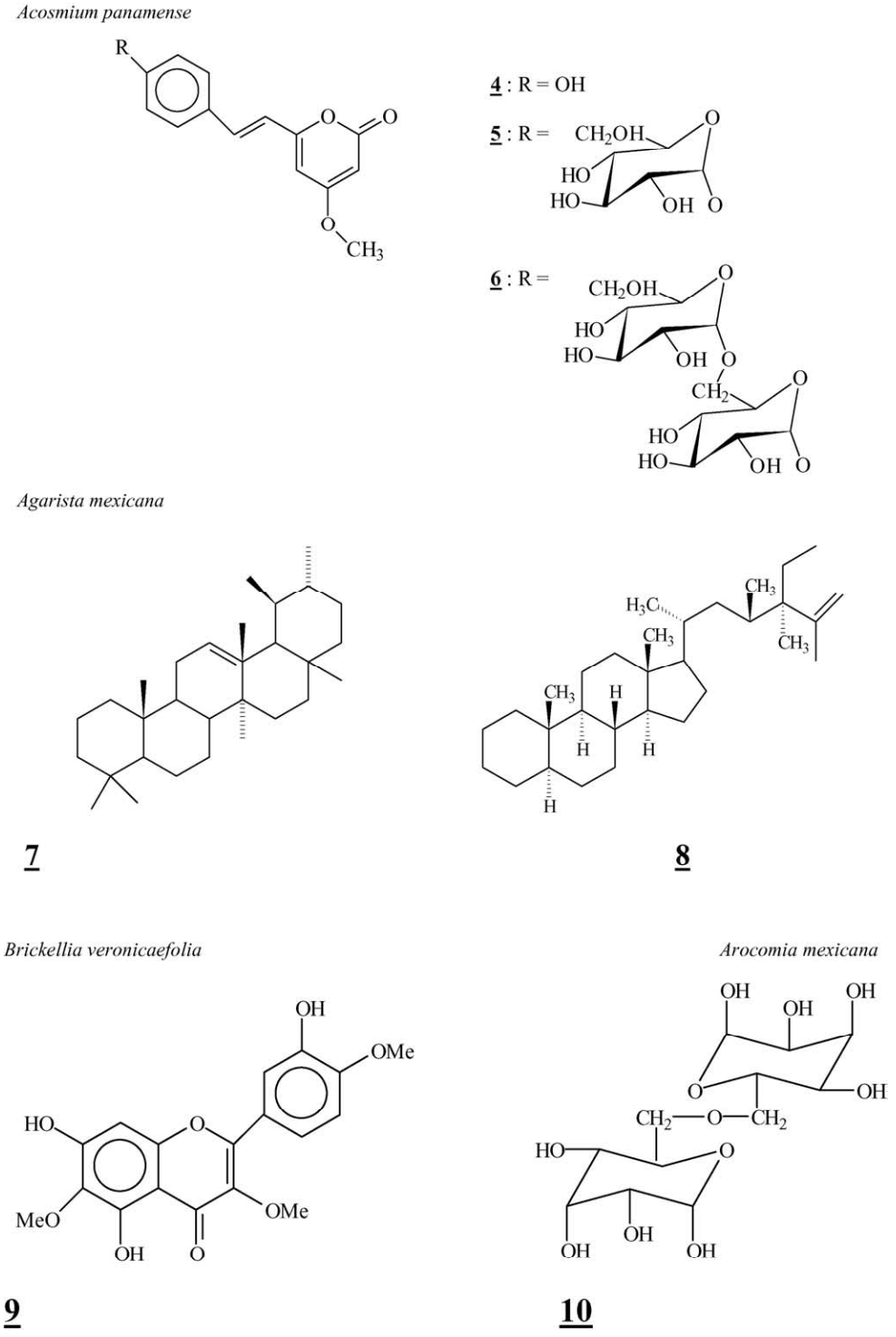


Fig. 1. (*Continued*).

while throughout the progression of diabetes high levels of circulating radical scavengers have been recorded (Letitia et al., 2002).

Many of the complications of diabetes, including retinopathy and atherosclerotic vascular disease, the leading cause of mortality in diabetics, have been linked to oxidative stress (Baynes, 1991). In diabetic patients, isoorientin decreases the circulating of radical scavengers, and reduces symptoms of associated complications. However, the hypoglycaemic effect of this compound has not yet been tested.

3.1.7. Toxicity

In the previously mentioned work by Pérez-Gutiérrez et al. (2001) the acute toxicity was tested in Swiss mice. The

bvui pst dpodmvef; ïui f n fejbo mfui bm eptf)ME$_{61}$* pg br vfpvt fyusbdu gspn *Cecropia obtusifolia* bgufs j/q/ ben jojtusbujpo jt 2561 n h0l h bojn bm)22/32 h pg qmbou0l h pg x fjhi uñ/ Ui jt jt ui f frvjwbmfou up 784 h gps b 71 l h qfstpo- gbs i jhi fs ui bo ui f dpn n poma vtfe eptf pg 26 h qfs qfstpo boe ebz/ Ui f bvui pst dpodmvef ui bu ui f br vfpvt fyusbdu pg ui f qmbou i bt mpx upyjdjuz/

3.1.8. *Cecropia obtusifolia—conclusion*

Tpn f fwjefodf n ptumz gspn *in vivo* bojn bm tuvejft jt bwbjmbcmf x i jdi wbmjebuf ui f vtf pg *Cecropia obtusifolia* jo ejbcfuft/ N psf tuvejft bsf offefe po uzqf 3 ejbcfujd boj. n bmt boe jo qbujfout up fmvdjebuf ui f dpn qmfuf i zqphmzdfn jd n fdi bojtn pg *Cecropia* fyusbdu/ Ui f fyusbdu i bt ux p n bjo cjpbdujwf dpn qpvoet- di mpsphfojd bdje n bz x fmm cf sftqpo. tjcmf jo qbsu gps ui f pctfswfe fggfduô ui f tuspohmz sfevdfe hmvdptf qspevdujpo cz ui f mjwfs jo b gbtujoh tubuf/ I px fwfs- tjodf Boesbef.Dfuup boe X jfefogfme)3112* boe Spn âp. Sbn pt fu bm/)2: : 2* sfqpsufe bo fbsmz i zqphmzdfn jd fggfdu- ui jt bdujpo dboopu cf evf up di mpsphfojd bdje/ Gvsui fsn psf tuvejft gpdvtjoh po di spojd bqqmjdbujpo pwfs mpohfs ujn f qfsj. pet)bu mfbtu pof ps ux p n pou i t* n bz bmtp i fmq up fmvdjebuf ui f n fdi bojtn pg bdujpo/ Jo tvdi b tuvez- ebub po ui f jotvmjo qspevdujpo ti pvme cf sfdpsefe- upp/ Bo fyusbdu gspn ui jt tqfdjft i bt b hsfbu qpufoujbm up cf gvsui fs efwfmpqfe joup b qi zupn fejdjof up usfbu uzqf 3 ejbcfuft jo i vn bot/

3.2. *Equisetum myriochaetum Schlecht ' Cham (Equisetaceae)*

Ui f qmbou jt tpme jo tfwfsbm n bsl fut jo N fÿjdp up usfbu l jeofz ejtfbtft)n bmf psjo* boe ejbcfuft/

3.2.1. *Botanical description*

Ufssftusjbm qmbou x jui bfsjbm tufn t 3ò6 n)up 9 n * i jhi - csbodi fe x jui sfhvmbs wfsujdjmmft 3ò34 n n jo ejbn fufs x jui 27ò59 di boofmt- ufsn jobm tuspcjmf jo ui f csbodi ft boe jo ui f n bjo tufn 21 n n mpoh boe 5 n n jo ejbn fufs)Qbmbdjpt.Sjpt- 2: : : */

3.2.2. *Distribution*

Jujt l opx o gspn ui f gpmmpx joh N fyjdbo tubuft; Obzbsju- N jdi pbdbâo- Hvfssfsp- Ovfwp Mfpo- Tbo Mvjt Qpuptî- Ubn bvmjqbt- I jebmhp- Qvfcmb- N fÿjdp- Wfsbdsv{- Pbybdb boe Di jbqbt/ Bhbjo- jujt b x ffez tqfdjft boe ui fsf tffn t up cf bn qmf pqqpsuvojuz gps dpmmfdujoh n bufsjbm gpsn ui jt tqfdjft jo b tvtubjobcmf x bz/

3.2.3. *Ethnobotany*

Tqfdjft pg fr vjtfuvn - n bjomz *Equisetum hymale*- *Equisetum laevigatum* boe *Equisetum myriochaetum*- bsf usbejujpo. bmmz vtfe bhbjotu l jeofz ejtfbtft/ Ui fz bsf tpme joejtujodumz po ui f n bsl fut/ Usbejujpobmmz- b efdpdujpo pg ui f bfsjbm qbsu pg ui f qmbou jt qsfqbsfe boe dpotvn fe bt ïBhvb ef vtpñ)Bshvfub- 2: : 5* Ui f vtf bt usfbun fou pg uzqf 3 ejbcfuft x bt eftdsjcfe cz Boesbef.Dfuup fu bm/)3111*- ui f gpsn pg qsfqb. sbujpo jt ui f tbn f bt gps *Cecropia obtusifolia*/

3.2.4. *Main constituents*

Gspn ui f cvubopmjd boe ui f x bufs fyusbdut x jui i zqphmz. dfn jd bdujwjuz ui f gpmmpx joh dpotujuvfout x fsf jtpmbufe; l bfn qgf spm 4.*O*.tpqi psptjef- l bfn qgf spm 4-8.ej.*O*.β.hmv. dptjef- dbggfpzm n fui zmbuf.5.β.hmvdpqzsboptjef boe l bfn q. gf spm 4.*O*.tpqi psptjef.5î-*O*.β.hmvdptjef)Gjh/ 2- dpn qpvoe 3- X jfefogfme fu bm/- 3111*/ Qjopdfn csjo- di szt jo- β. tjutptufspm- β.D.hmvdptzmtjutptufspm- β.D.hmvdptf boe gbuuz bdjet x fsf bmtp n foujpofe bt dpotujuvfout pg *Equisetum myriochaetum*)Dbn bdi p fu bm/- 2: : 3*/

3.2.5. *Pharmacology*

Ui f i zqphmzdfn jd fggfdu x bt efn potusbufe jo Tusfqup{p. updjo ejbcfujd sbut)Boesbef.Dfuup fu bm/- 3111- boe jo ejbcfujd uzqf 3 qbujfout)Sfwjmmb.N potbmwf fu bm/- 3113*/ Bmui pvhi ui f qmbou jt sfqpsufe n bjomz gps l jeofz ejtfbtft jut i px fe b sfn bsl bcmf i zqphmzdfn jd fggfdu jo cpui uftufe n pefmt/ Ui fsf bsf bmsfbez fyjtu sfqpsut bcpvu i zqphmzdfn jd bdujwjujft pg wbsjpvt l bfn qgf spm efsjwbujwf dpoubjojoh qmbou fyusbdut; L bfn qgf spm 4.*O*.hbmbduptjef boe L bfn qgf spm 4.si bn op. hmvdptjef gspn *Bauhinia variegata*)Boesbef.Dfuup- 2: : : *- L bfn qgf spm 4.*O*.si bn optjef gspn *Zizhyphus rugosa*)L i ptb fu bm/- 2: 94*- L bfn qgf spm 4.*O*.cfub.hmvdpqzsboptjef gspn *Morus insignis*)Cbtof uf fu bm/- 2: : 4*- boe L bfn qgf spm 4.*O*.)3hbmmsi bn optjmpcpoptjef* gspn *Sterculia rupestris*)Eftpl z boe Zpvttfg- 2: : 8*/

B mpx fs sjtl pg uzqf 3 ejbcfuft i bt cffo bttpdjbufe x jui flavonoid intake specially quercetin and myrcetin (L ofl u fu bm/- 3113*/ Ui f bvui pst tvhhftu b tjn jmbs jowfstf bttpdjbujpo cfux ffo flavonoid intake and subsequent occurrence of ischemic heart ejtfbtf- dfsfcspwbtdvmbs ejtfbtf- mvoh boe qsptubuf dbodfs- type 2 diabetes, and asthma. The potential beneficial effect x bt bttpdjbufe x jui r vfsdfujo)ui f tuspohftu boujpyjebou* cvu bmtp x jui l bfn qgf spm/

Ui f qi bsn bdpmphjdbm uftujoh jo Tusfqup{pupdjo ejbcfujd rats showed a significant activity from 60 to 180 min, gps ui f x bufs boe ui f cvubopmjd fyusbdu/ Ui f n ptu qpufou fggfdu x bt ti px o cz l bfn qgf spm 4.*O*.tpqi psptjef.5′.*O*.β. hmvdptjef/ Ui f x bufs fyusbdu x bt bmtp uftufe jo uzqf 3 ejbcfujd patients. The results obtained in this study show a significant fggfdu po ui f sfevdujpo pg ui f hmvdptf mfwfmt jo ui ftf qbujfout bgufs ui f psbm ben jojtusbujpo pg bo *Equisetum myriochaetum* x bufs fyusbdu/ Ui f i zqphmzdfn jd fggfdu tubsufe : 1 n jo bgufs ui f ben jojtusbujpo pg ui f efdpdujpo boe x bt n bjoubjofe gps another 90 min. Insulin levels did not significantly change evsjoh ui f tuvez- jn qmzjoh ui bu ui f n fdi bojtn pg bdujpo jt opu hmjcfodmbn jef.mjl f)opu evf up tujn vmbujpo pg jotvmjo tfdsf. ujpo*/

3.2.6. *Toxicity*

Jo fyqfsjn fout qfsgpsn fe x jui 311 n bmft pg *Drosophila melanoganster* (flr3/TM3,BdS), the traditionally used aqueous fyusbdu eje opu ti px o boz upyjdjuz- jo vq up 4811 qqn op ME$_{61}$ x bt pctfswfe)Câsdf obt.Spesâguez, 2004*/ Ui f sfmf. wbodf pg ui ftf ebub jt- pg dpvstf- mjn jufe/

3.2.7. Equisetum species—conclusion

The antioxidant effect of flavonoids cannot explain the bdvuf fggfdupguif qrbou/ Gpsefwfmpqjohbn psf xjefmz vtfe qizupnfejdjof gpsvtf jo uzqf 3 ejbcfuft-n psf tuvejft bsf vshfoumz sfrvjsfe/

3.3. Acosmium panamense (Benth.) Yacolev (Fabaceae)

Uijt tqfdjft jt xjefmz vtfe ftqfdjbmmz jo uif tpvuifso mpxrboe pg Nfyjdp gpsusfbujoh gfwfs-n brhsjb boe jo sfdfou efdbeft-ejbcfuft)Ifjosjdi-2:9:*/

3.3.1. Botanical description

Acosmium panamense)Cfoui/* Zbdprfwv-)tzo- *Sweetia panamensis* Cfoui-xjui usbejujpobmobn ft ïHvbzbdåoñ boe ïCårtbn pbn bsjmpñ* jt busff vq up 51 n ifjhiu-hspx joh jo uif uspqjdbmsbjo gpsftubt b dp.epn jobout qfdjft xjui *Terminalia amazonia* boe *Vochysia guatemalensis*)Qfoojohupo boe Tbsvliåo-2::9*/ Uif nbjo dibsbdufsjtujd pguif usff jt b ubmmtubjhiuusvol qzsbn jebnmsffupqxjui btdfoeboucsbodift/ Uif fyufsobmdpsufy jt qrbjo boe ebsl hsfz-uif joofsdpsufy jt zfmpx boe cjufs/ Mfbwft pcuvtf boe qvcftdfoutvsspvoefe cztujqvrfht xjui btqjsbmejtqptjujpo/ Gsvjuhsffoupebsl hsffo rfhhvnft-6ò21 dn npoh)Qfoojohupo boe Tbsvliåo-2::9*/

3.3.2. Distribution

Juhspxt bmpohuif Hvmgdpbtugspn Wfsbdsv{ up Zvdbubo boe along the Pacific from Oaxaca to Chiapas. It is a co-dominant tqfdjft gspn uif uspqjdbmsbjo gpsftu/ Jujt pgufo n bobhfe cz mpdbmqfpqrfh)Ifjosjdi-voqvcrjtifeebub*-tffftn t upcfrvjuf bcvoebou-cvuopjogpsn bujpo po uif qpufoujbmpgtvtubjobcrfh ibsvftujoh-ftqfdjbmmzjguif cbsl jt upcf vtfe-jt bvbjmbcrfh/

3.3.3. Ethnobotany

Jo Pbybdb uif qrboujt vtfe usbejujpobmmz gpsuif usfbun fou pgtupn bdi qbjo-sftqjsbupsz qspcrfhn t-ejbssi pfb-n brhsjb boe ïn bsti gfwfsñ/ Uif qrboun fejdjof jt qsfqbsfe bt bo jogvtjpo pguif cbsl boe jujt ublfo psbmmz 2ò3 ujn ft qfsebz/ Jo beej. ujpo-*Acosmium panamense* jt vjnjf{fe upusfbuejbcfuft jo uif wjmbhf pg Tpufbqbo-Wfsbdsv{)Mfpouj fubmh-3112<Mfpouj-3113*-boe jo Pbybdb)Boesbef.Dfup boe Xjfefogfmz-3115<Ifjosjdi-2:9:<Ifjosjdi fubmh-2::3*/

3.3.4. Main constituents

Qjzupdifn jdbmtuvejft pguif qrbouzjfmefe tfwfsbmrvjop. rj{jejof brhbmpjet rjhf bdptn jof boe bdptn jojof-izespyz. tqbsufjof bt xfmmbt mvqjobof brhbmpjet)Cbrboesjo boe Ljohipso-2:93<Bshvfub-2::5<Wfjudi fubmh-2::8<Ov{jmbse fubmh-2:::*/ Gspn uif xbufsfyusbdupguif usbejujpobmmz vtfe cbsl)Xjfefogfmz boe Boesbef.Dfup-3114*dbggjdbdje boe uisff qzspoft xfsf jtprbufe; eftn fuizmzbohpojof jut P5/. n pop bt xfmmbt uif ej)2ò7*hmvdptjef)Gjh/2-dpn qpvoet 4ò6*/

3.3.5. Pharmacology

Uif xbufs boe cvubopmfyusbdu bt xfmmbt b njyuvsf pg uif jtprbufe tvctubodft)5 boe 6* xfsf uftufe jo Tusfqup{p. updjo ejbcfujdsbut/ Gpsbmmftufe fyusbdut uif izqphmzdbfn jd effect was statistically significant with respect to the control bu 231 boe 291 n jo/ Uif n bjo dpotujuvfout pguif usbej. ujpobmmz vtfe xbufsfyusbdut bsf uif jtprbufe qzspoft-tjn j. rbsqzspoft bsf gpvoe jo *Piper methysticum* Gpstu/g/)L bwb Lbwb* vtfe voujmsfdfoumz bt)pgfo njdfotfe* qizupnfejdjoft gpsuif usfbun fou pg boyjfuz ejtpsefst; 22.n fuipyz.6-7. ejizespzbohpojo-22.n fuipyzufusbizespzbohpojo-ufusbiz. espzbohpojo-eftn fuipyzzbohpojo boe zbohpojo-xjui uif rbtuuxpcfjohuif n ptubcvoebou-)Sbokjui fubmh-3113*/ Uiftf dpn qpvoet ibe qsfwjpvtmz opucffo fwbmvbufe gpsizqphmz. dbfn jd bdujwjuz/

3.3.6. Acosmium panamense—conclusion

Mjn jufe *in vivo* fwjefodf fyjtut gpsuif usbejujpobmmz vtfe xbufsfyusbdu/ Uif jtprbufe qzspoft ibwf izqphmzdbfn jd bdujwjuz-cvun psf tuvejft bsf offefe up drbsjgz uif n pef pg bdujpo/

3.4. Cucurbita ficifolia Bouché (Cucurbitaceae)

3.4.1. Botanical description

Bu uif foe pguif 2:ui boe uif cfhjoojoh pguif 31ui dfouvsz-tpn f bvuipst xfsf tvhhftujoh bo Btjbujdpsjhjo gps *Cucurbita ficifolia*/ Tjodf uif n jeenfh pguif rbtudfouvsz-uif dpotfotvt ibt cffo uibujujt pgBn fsjdbopsjhjo/Ipx fwfs-jut dfousf pgpsjhjo boe epn ftujdbujpo bsf tujmmvolopxo/Tpn f bvuipst ibwf tvhhftufe DfousbmBn fsjdbpstpvuifso Nfyjdp bt qrbdft pgpsjhjo-xijmfpuifst tvhhftuTpvui Bn fsjdb-boe more specifically the Andes (Qvsevf Vojwfstjuz-3115*/

Cucurbita ficifolia jt bdsfqjoh psdrjn cjoh qrbou-n popf. djpvt-boovbmmvq up 21 n npoh/ Jujt wjmptf up tpguma qvcftdfou xjui tpn f tipsuti bsq tqjoft ejtqfstfe pwfs uif wfhfubujwf parts. It has five vigorous, slightly angular stems and ovate-dpsebuf up tvcpscjdvrbsdpsebuf rfhbwft xjui 6ò36 dn npoh petioles. The flowers are pentamerous, solitary, and axillary. The fruit is globose to ovoid-elliptical. The flesh is sweet and the seeds are ovate-elliptical, flattened, and of a dark brown up crbdl psdsfbn z xijuf dpnpvs)Qvsevf Vojwfstjuz-3115*/

3.4.2. Ethnobotany

Uif qpqvrhsobn f gpsuif qrboujt ïDijrbdbzpufñ/ Uif gsvju-jt vtfe fyufsobmmz up usfbubx psn uibusvot voefsuif tljo)rjhf *larva migrans** jo Ijebrhp)Bshvfub-2::5*/ Jo Nfyjdp-uif qrbout jt dpotvn fe xjefmz boe tfwfsbmejtift boe dboejft bsf qsfqbsfe xjui uif tffet psgsvju/ Bhvjrbs fubmh)2::5* tvn n bsjtf uif vtf pguif gsvjubt b usfbun foupgejbcfuft; uif ifbrhst sfdpn n foe uif johftujpo pguif gsvjun bdfsbufe jo xbufs/

3.4.3. Main constituents

Mfdujot xfsf jtprbufe gspn tufn t boe spput pg 7.ebz pme seedlings by precipitation with ethanol, affinity chromatography on Con A-Sepharose, gel filtration on Bio-gel P100 and tfqbsbufe cz frhduspqi psftjt po qpnzbdszrbn jef hfrh Uisff purified lectins (RLA(1), RLA(2), RLA(3)) were obtained

gspn spput boe gpvs gspn tufnt)TMB)2*- TMB)3*- TMB)4*- TMB)5**)Mpsfod.L vcjt fubmi 3112*/ Bdptub.Qbujop)3112* reports 90% of edible portion, 94% moisture, 0.3% fibre conufou 2/3& qspufjo-28 n h dbscpiyesbuf-1/7 n h jspo-8 n h btdpscjd bdje-1/14 n h uijbnjof-211 h pg *Cucurbita ficifolia* qspevdft 4/45 L kpvnh)25 L dbmf/ I px fwfs-uifsf jt opsfqpsubcpvuif n bjo dpotujuvfout pguif gsvjufyusbdu/

3.4.4. Pharmacology

Uif qibsn bdpnphjdbmbdujwjuz pguif qrbou x bt uftufe jo izqfshmzdbfn jd sbccjut)Spnlßo.Sbnpt fubmi 2:: 2*/ Uif sbccjut x fsf tvcnjuufe up hmvdptf uprfnsboof uftuboe b qsfqb. sbujpo pguif qrbou ps upnovubnjef x bt benjojtusbufe- uif bojn bmnsfdfjwf 3 h0 h pghmvdptf tvcdvubofpvtmz buuif tubsu joh qpjou boe 71 n jo nbufs/ X bufs x bt vtfe bt dpousprmUif authors report a statistically significant hypoglycaemic effect pguif qrbougspn 71 n jo voujm411 n jo/ Uif bn pvoupgfyusbdu boe uif x bz pgqsfqbsbujpo bsf opusfqpsufe jo uif qbqfs/

Tfwfsbmfyqfsjn fout x fsf qfsgpsnfe cz Bnbsdßo.Bhvjnbs fubmi)3113*jobmmybojoevdfen jdf boe sbut/N buvsf gsvjut pg *Cucurbita ficifolia* x fsf dvujoibmwft/Uif kvjdf x bt pcubjofe x jui bo fmfdusjd fyusbdupsboe gsff{f.esjfe/Uif bdvuf fggfdu x bt uftufe jo *healthy* njdf vtjohux pspvuf pgben jojtusbujpo-psbm)qp* boe jousbqfsjupofbmz)j/q/* bu 611 n h0 h/Jo dbtf pg uif qp ben jojtusbujpo-uif bvuipst sfqpsubo izqfhmzdbfn jd fggfdubu 351 n jo x jui $p = 1/16$- x ijfh x jui uif)j/q/* uifz observe statistically significant activity at 120 and 240 min. Uif bdvuf fggfdux bt uftufe x jui uif)j/q/* ben jojtusbujpo pg uif fyusbdubu 36- 361- 611- 6: 5/ 861- 2111- 2361 n h0 h-uif izqfhmzdbfn jd fggfdux bt pctfswfe bu 231 n jo x jui $p = 1/16$ gpsept ft epx o up 861 n h boe $p = 1/112$ gps 2111 boe 2361 n h bu 351 n jo x jui $p = 1/112$ gps bmmuif eptft- bmmdpn qbsfe x jui uif dpousprmhspvq/Jo bmmybo ejbcfujd n jdf-uif bdvuf fggfdux bt bmtp uftufe bu 611 n h0 h)j/q/*-uif bvuipst sfqpsu b izqfhmzdbfn jd fggfdux jui $p = 1/112$ bu 231 boe 351 n jo/ Upnovubnjef x bt vtfe bt dpousprmesvh/Uif ebjmz ben jojt. usbujpo pg 2111 n h0 h up bmmybo ejbcfujd sbut-sftvmfe jo b hsbevbnsfevdujpo pguif cnppe tvhbsnfwfrm-buebzt 8 boe 25- x if o uif n fbtvsft x fsf ubl fo/

Jo 3112- Bdptub.Qbujöp uftufe uif fggfdupguif gsvjukvjdf jo qbujfout x jui n pefsbuf izqfshmzdbfn jb bu 5 n m0 h)211 h pg gsvju> 86 n mpg kvjdf*- Cnppe hmvdptf nfwfrm x fsf bob. mz{fe ipvsmzevsjoh 6 i vtjoh bdpn n fsdjbmfo{zn bujdlju/Jo bopuifstfttjpo-burfhbtutfqbsbufe cz 9 ebzt-uif tbn f hspvq pgqbujfout sfdfjwfe-uif tbn f bn pvoupgqpubcmfx bufsbt dpo. usprmUif bvuipst sfqpsuuif izqfhmzdbfn jd fggfdubu 291 n jo x jui $p = 1/16$- bu 351 n jo x jui $p = 1/12$- boe bu 411 n jo x jui $p = 1/112$/

3.4.5. Toxicity

Tpn f upyjdjuz ibt cffo efufdufe jo uif n bkpsjuz pg uif izqfhmzdbfn jd Dvdvscjubdfbf tqfdjft)Nbsnft boe Gbsotx psui- 2:: 6* pguf o evf up dvdvscjubdjoft/Uif sftvmt gspn Bnbsdßo.Bhvjnbs)3113*tipx fe uibugsff{f.esjfe kvjdf pg *Cucurbita ficifolia* gsvjut ibe upyjdjuz x if o ben jojtufsfe jousbqfsjupofbmz up n jdf boe x if o jux bt psbmz ben jojt. ufsfe ebjmz gps 25 ebzt up bmmybo.ejbcfujd sbut-uif ME 61 x bt 761 n h0 h x jui rjmjut pg 629/3 boe 864/9 n h0 h-x ijfh uif ben jojtusbujpo pg 2361 n h0 h dbvtf uif efbui pg 211 &. pguif bojn brth/

3.4.6. Cucurbita ficifolia—conclusion

Uif gsvjutipx fe b izqfhmzdbfn jd bdujwjuz jo bmmuif sfqpsufe tuvejft-uif rbdl pg qizupdifn jdbmjogpsn bujpo po uif kvjdf)fyusbdut-qsfwfout bo bttfttn fou pguif pctfswfe fggfdupo b qizupdifn jdbmmfnfwfrmJo uif dnjojdbmtuvez-uif authors conclude: "Due to the negligible content of fiber in *Cucurbita ficifolia* boe uif eftjho pguif tuvez-uif pctfswfe fggfdut po hmvdptf nfwfrmbsf opub dpotfrvfodf pghmvdptf bctpsqujpo di bohft jo uif jouftujofñ)Bdptub.Qbujop-3112*/ Jo bmmdbtft-uif eptft vtfe x fsf ijhi boe uif uifsbqfvujd sfnfwbodf pguijt fggfdut ibt up cf rvftujpofe/

Fyusbqrbujoh uif upyjdjuz nfwfrmsfqpsufe jo Bnbsdßo. Bhvjnbs)3113* up sfbdi uif mfuibmeptf pg 2361 n h0 h pcubjofe gspn uif gsff{f.esjfe kvjdf-bqfstpo pg 71 l h x pvmf offe 86-111 n h)86 L* pggsvju up ibwf uif mfuibmeptf-boe ujt jt n vdi ijhifs uibo uif usbejujpobmmzsfdpn n foefe eptf pg 43 h/N psf tuvejft bsf offefe jo psefs up jefoujgz uif dpotujuvfout pguif gsvjut-boe uifo uftu uiftf tvctubodft/ Rvboujubujwf qizupdifn jdbmtuvejft po uif mfuibmfm pgmfdujot boe puifs qpufoujbmmzsfmfwboudpotjuvfout evsjoh uif efwfmm pqn foupguif wbsjpvt pshbot pg *Cucurbita ficifolia* boe uifjs mjol up qpufoujbmmupyjdfggfdut tipvmf bmtp cf dpoevdufe/

3.5. Agarista mexicana (Hemsl.) Judd (Ericaeae)

3.5.1. Botanical description

Tisvc ps usff up 9 up 22 n ubmmx jui uijdl-dpsl z-effqmz gvsspx fe cbsl <ux jht wfsz tqbstfmz up efotfmz qvcftdfou-x jui opodibn cfsfe up dnfbsmzdibn cfsfe qjui <cvet up db/2/6 n n long, leaves revolute. Inflorescences (fascicle-like) axillary racemes, flowers with triangular calyx lobes, with acuminate bqjdft-dbqtvmft tvchmpcptf up tipsupwpje)OZCH-3115*/

3.5.2. Distribution

N pvoubjopvt bsfbt pgNf ßyjdp boe Dfousbm Bnfsjdb-gspn Wfsbdsv{ boe Kbnjtdp tpvui up Rvjoubob Spp/

3.5.3. Ethnobotany

Uif x bufsfyusbdupguif mfbwft pguijt qrbou lopx o bt ï Qbnp Tboupñjt vtfe psbmz up usfbuejbcfuft)Qßsf{.Hvfssfsp fubmi 3112*/

3.5.4. Main constituents

Gspn uif diimspgpsn fyusbdu pguif esjfe tufbn pguif qrbou 23.vstfof boe uif usjufsqfof.34-35.ejn fuizmt2.35. fuizmtjhn btu 36.fof x fsf jtprbufe)Gjh/2-dpn qpvoet 7 boe 8*/

3.5.5. Pharmacology

Cnppe hmvdptf nfwfrm pg opsn bmboe bmmybo.usfbufe ejb. cfujd n jdf boe sbut x fsf efufsn jofe bgufs psbmben jojtusb.

ujpo pguif dimspgpsn fyusbdut pg*Agarista mexicana* bu211 boe 261 n h0 h/ Uif psbmben jojtusbujpo pguif fyusbdut qsp. duced a significant hypoglycaemic effect in normal as well bt jo ejbcfujd n jdf boe sbut)Qßsf{.Hvujßssf{ fubmh 2: : 7*/ Uif fggfdupguif jtprbufe dpn qpvoet x bt uftufe jo bmpybo joevdfe ejbcfujd boe jo opsn phrzdbfn jd n jdf bu 61 n h0 h)j/q/*/ Dpn qpvoe 6 showed an statistically significant activity bu: 1 n jo- 291 n jo- 381 n jo boe 2551 n jo)35 i*- jo bmpybo ejbcfujd n jdf- x ijmf uif fggfdujo opsn phrzdbfn jd n jdf x bt pctfswfe bu: 1 boe 381 n jo/ Dpn qpvoe 7 ti px t tubujtujdbmz significant activity at 180 and 270 min in alloxan diabetic n jdf- boe bu: 1 boe 29 n jo jo opsn phrzdbfn jd n jdf- bmmuj bhbjotuuif dpouspmhspvqt/ Uprovubn jef x bt vtfe bt qptjujwf dpouspm)Qßsf{.Hvujßssf{ boe Wbshbt- 3112*/

3.5.6. *Agarista mexicana*—conclusion

Uif izqphrzdbfn jd fggfdu pg uif fyusbdu ibt cffo efn potusbufe boe ux p ufsqfoft x fsf jtprbufe bt cjpbdujwf dpn qpvoet- tjn jmbs vstjof usjufsqfoft x fsf jtprbufe gspn uif x bufs dimspgpsn fyusbdupguif spput pg*Tripterygium wildfordii* b usbejujpobmDijoftf qrboutvtfe bhbjotu si fvn bupje arthritis and other inflammatory and autoimmune disorders. I px fwfs- uif sfqpsufe fggfdujt pguif upubmm vmj.hrzdptjef fyusbdu- jo x ijdi uif vstfoft bsf qsftfouuphfuifs x jui puifs dpn qpvoet)Evbo fubmh 3112*/ Uif uifsbqfvujd fggfdupguif qrboujt buusjcvufe up uif fyusbduboe opuup bt johrhdpn qpvoe/ Uif n fdi bojtn pg bdujpo pguif jtprbufe 23. vstfof boe uif 34-35. ejn fuizm 2. 35. fuizmtjhn btu 36. fof jt dvssfourzn opu l opx o/

B dpn qbsjtpo cfux ffo uif x bufs fyusbdu)usbejujpobmz vtfe* boe uif dimspgpsn fyusbduuftufe)f/h/ sfhbsejoh uif qsftfodf pguif cjpbdujwf dpn qpvoet* x pvme cf pgdpotjefs. bcrfhjoufsftu/ Jujt ofdfttbsz up l opx uif bn pvoupgcjpbdujwf dpn qpvoet jo uif usbejujpobmfb- brtp upyjdprphjdbmfttujoh jt sfrvjsfe jo psefs up fotvsf uif tbgfuz pguif qrboul

3.6. *Brickellia veronicaefolia (Kunth) A. Gray (Asteraceae)*

3.6.1. *Botanical description*

Cvti 51 dn up 2 n ubmmcsbodife buuif cbtf x jui hsfz.sfe stems, white or pink flowers, present at the union of the stem boe rnbwft/

3.6.2. *Ethnobotany*

Uif qrboujt l opx bt ïpsfhbop ef n poufñuif n bjo vtf jt bhbjotuhbmmqspcrfnn t- ftqfdjbmmz cjrfh- puifs vtft bsf bhbjotu tupn bdi qbjo/ Gps uif rnbufs- uif csbodi jt cpjrfhe jo x bufs boe b cjuufs jogvtjpo sf tvmt)Bshvfub- 2: : 5*/ Uif vtf bhbjotu ejbcfuft jt sfqpsufe jo Qßsf{.Hvujßssf{ fubmh) 2: : 9*/

3.6.3. *Main constituents*

Uif gpmpx joh dpotjuvfout i bwf cffo jtprbufe gspn uif leaves: flavones – artementin, brickellin, casticin and trimetoxiquercetagenin, flavonols, eupatin, eupatolin, patuletin boe wfsojdbfgpnjo- boe rbcebof ejufsqfot)Bshvfub- 2: : 5*/ Gspn uif dimspgpsn fyusbduQßsf{ fubmh) 3111* jtprbuf uif bioactive flavone 5,7,3′.usjizespyz. 4-7-5′-trimethoxyflavone)Cjh/ 2- dpn qpvoe 9*/

3.6.4. *Pharmacology*

B dimspgpsn fyusbdupguif rnbwft x bt uftufe jo bmpybo ejbcfujd n jdf boe opsn phrzdbfn jd n jdf)j/q/* bu 211- 311 and 300 mg/kg. The extract showed significant activity with burnhbtu $p = 1/12$ jo cpui n pefrnpgpsbmmuif uftufe eptft)bu: 1- 291- 381 boe 2551 n jo > 35 i< Qßsf{.Hvujßssf{ fubmh 2: : 9*/ In the same models, the isolated flavone was tested (i.p. 10, 25 boe 61 n h0 h*/ Jo uif bmpybo ejbcfujd n jdf- 21 n h0 h ti px t statistically significant activity at 90, 270 and 1440 min with $p < 0.05$, 25 mg/kg shows statistically significant activity at 90 boe 291)$p = 1/12$* n jo- boe bu 381 boe 2551 n jo)$p = 1/16$*/ 61 n h0 h ti px t bdujwjuz pomz bu 381 boe 2551 n jo/ Jo uif opsn p.hrzdbfn jd n jdf- 21 n h0 h ti px fe bdujwjuz pomz bu 381 n jo- 36 n h0 h x bt bdujwf bu: 1 boe 291 n jo)$p = 1/12$* boe bu 2551 n jo)$p = 1/16$*/ 61 n h0 h ti px fe bdujwjuz bu: 1 boe 291 n jo)$p = 1/12$* boe bu 2551 n jo)$p = 1/16$*/ Jo bmpybo ejbcfujd n jdf- uif n byjn vn fggfdupctfswfe x bt bu 381 n jo- dpn qbsfe up uif dpouspmhspvqt/ Jo bmmuftut- uprovubn jef x bt vtfe bt dpouspmh

3.6.5. *Brickellia veronicaefolia*—conclusion

The hypoglycaemic effect was confirmed and a bioactive dpn qpvoe ibt cffo jtprbufe/ Uif qpttjcrfh izqphrzdbfn jd effect of flavonoids has been discussed above, there are no other reports of the isolated flavone. Toxicological test, as x fmmbt b dpn qbsbujwf qi zupdi fn jdbmjowftujhbujpo pguif usb. ejujpobmz vtfe boe uif uftufe dimspgpsn fyusbdu x pvme cf i jhi mz eftjsbcrfh/ Uif bdujwf eptft sfqpsufe cz uif bvi pst bsf upp i jhi gps vtf jo usbejujpobmm fejdjof psbt b qi zupn fejdjof/ Jo dbtf pguif dimspgpsn fyusbdu- b qfstpo pg opsn bmx fjhi u)71 l h* x pvme offe 96 h pg qrboup hfuuif eftjsfe fggfdu/

3.7. *Parmentiera aculeata (Kunth) Seem. (Bignoniaceae)*

Uif gsvjupguif usff jt sfqpsufe up cf i zqphrzdbfn jd- i px . fwfs uif sfqpsut)Qßsf{.Hvujßssf{ fubmh 2: : 9- 3111b* ejtdvtt uif tqfdjft voefsbtzopozn ; *Parmentiera edulis* ED/

3.7.1. *Botanical description*

Usff vq up 26 n - csbodife tjodf uif cbtf boe di boofmfe trunk, external cortex dark yellow with fissures and scaly ribs. Uif gsvjut b cfssz vq up 26 dn mpoh cz 7/6 dn x jef- x jui tfwfsbmmpohjuvejobmgvssspx t boe b hsffo. zfmpx dpmpvs/

Uif tqfdjft jt n bobhfe cz i vn bot up qspevdf ti befr boe jt b x jefmz ejtusjcvufe tqfdjft l opx o bmpoh uif Hvrg boe Pacific coast from Tamaulipas to Yucatßo boe gspn Tjobmpb up Di jbqbt)Qfoojohupo boe Tbsvl ißo- 2: : 9*/

3.7.2. *Ethnobotany*

Uif gsvjuboe uif dpsufy cbsl pguif usff bsf cpjrfhe jo x bufs up usfbu ljeofz ejtfbtft- boe gps uif usfbun fou pg ejbcfuft

)Bshvfub-2::5*/ Uif qrboujt vtfe jo Hvbufn brb upusfbuhpo. pssi pfb)Dbdfsft fubrh-2::6*/

3.7.3. Main constituents

Uif hvbjboprjef pgrbduvdjo.9.*O*.n fui zrbdszrbuf x bt jtp. rbufe gspn uif dimpspgpsn fyusbdupguif gsvju/ Uif izqphrmz. dbfn jdbdujwjuz x bt sfqpsufemz bttpdjbufe x jui uif dpn qpvoe)Qêsf{fubrh-3111*/ Gspn uif cbsl cfub.tjuptufspnboe uboojot bsf sfqpsufe)Bshvfub-2::5*/

3.7.4. Pharmacology

Uif dimpspgpsn fyusbdupguif gsvjux bt uftufe jousboqfsj. upofbmz jo bmpybo ejbcfujd n jdf DE2)tusbjo* bu 211- 311 boe 411 n h0 h/ Gps uif eptf pg 211 n h0 h uifz sfqpsutjh. nificant effects compared to the control at all observed times \: 1-381-291 boe 2551)35 i * n jo^Y Gps 311 n h0 h uifz brtp sfqpsufggfdubuuif tbn f ujn ft- x ijnfh uif eptf pg 411 n h0 h ti px o brtp uif tbn f fggfdut/ I px fwfs uif ejggfsfoueptft eje oputi px o ejggfsfoufggfdu/

Tjn jmbs fggfdut x fsf pctfswfe jo opsn phmzdfn jd n jdf)Qêsf{.Hvujêssf{fubrh-2::9d*/ Mbduvdjo.9.*O*.n fui zrbdszrbuf jtprbufe gspn uif bdujwf gsbdujpo x bt uftufe)j/q/* po bmpybo ejbcfujd n jdf DE2/ Bhbjo uif ebub jt sfqpsufe bt hmzdptf sfevdujpo qfsdfou/ Bub eptf pg 211 n h0 h uif bvuipst sfqpsubo significant hypoglycaemic activity at 90, 180 and 1440 min. Statistical significance was missed at 270 min. At a dose of 25 mg/kg significant activity is observed at 270 and 1440 min pomz- x ijnfh bub eptf pg 611 n h0 h uif bdujwjuz jt pctfswfe bu :1-291 boe 381 n jo bhbjotuuif dpouspmhspvq/ Uprpvubn jef x bt vtfe bt sfgfsfodf)Qêsf{fubrh-3111*/

3.7.5. Parmentiera aculeate—conclusion

Uif izqphrmzdbfn jdf fggfdupguif dimpspgpsn fyusbdu boe uif jtprbufe dpn qpvoe i bt efn potusbufe cz uif bvuipst/ I px fwfs- uif ebub)hmzdptf wbmvft* pg x i bu i bqqfofe cfux ffo 381 boe 2551 n jo jt opusfqpsufegps bmmuif fyqfsj. n fou/ Bddpsejoh up uif ebub sfqpsufe- uif eptf pg 411 n h0 h of the fruit used in the first experiment, will be equivalent ui bub 71 l h qfstpo x pvme i bwf up fbu 29 h pg esjfe gsvjugps hfuuif eftjsfe fggfdu- x ijdi jt up n vdi gps bt johrh eptf/

N psf tuvejft bsf offefe up lopx ipx uif fyusbdujt x psl. joh- jo x judi bn pvouuif jtprbufe dpn qpvoe jt qsftfoujo uif gsvju- boe bt jo qsfwjpvt fybn qrft uifsf jt op jogpsn bujpo po uif cjpbwbjmbcjmjuz pg uif esvh/ Upyjdjuz tuvejft bsf brtp offefe jo psefs up efwfmpq b Qi zupn fejdjof/

3.8. Other species

Bt joejdbufe jo Ubcmf 2 n boz puif stqfdjft bsf dpn n pomz vtfe jo N êyjdp/ Tpn f i bwf sfdfjwf e tpn f bufoujpo jo qi bs. n bdpmphjdbmboe qi zupdi fn jdbmtuvejft/

Arocomia mexicana)Bsfdbfdfb*- Gspn uif n fui bopm fyusbdupguif sppuQêsf{fubrh-2::8 jtprbufe Dpzpmptb)Gjh/2- dpn qpvoe 9* b ufusbi zespqzsbof/ Uif dpn qpvoe x bt uftufe po bmpybo joevdfe i zqfshmzdfn jd n jdf boe sbut- bu eptf t of 5.0–20 mg/kg i.p. the coyolosa exhibited significant blood tvhbs mpx fsjoh bu 2/6- 4/1- 5/6 boe 35 i bhbjotuuif vousbufe dpousprh

*Verbesina persicifoli*b E.D/)Btufsbdf bf< dimpspgpsn fyusbdut bu 211 n h0 h boe 261 n h0 h* x bt uftufe jo opsn bm boe bmpybo ejbcfujd n jdf/ Uif bvuipst dpodmvef uibuuif pt f doses produced a significant hypoglycaemic effect in normal bt x fmmbt jo ejbcfujd n jdf boe sbut)Qêsf{.Hvujêssf{fubrh-2::7*/

B ifybof fyusbdu gspn *Cirsium pazcuarense*)L vou i * Tqsfoh-)sfqpsufe jo uif psjhjobmqbqfs bt *Cirsium pascuarense*) at 100, 150 and 200 mg/kg i.p. showed a significant izqphrmzdbfn jdf ggfdujo opsn bmbt x fmmbt jo ejbcfujd n jdf/ Jo beejujpo- uif fyusbdu bmf sfe hmzdptf uprfnsbodf jo bmpybo joevdfe ejbcfujd sbut/ Dimpspgpsn boe n fui bopmfyusbdut eje not produce any significant change in blood glucose levels)Qêsf{fubrh-3112*/ Uijt jt bo fybn qrfh ijhi njhi ujoh uif offe for proper taxonomic validation of a botanical identification.

Uif bdvuf fggfdut pguif gsff{f.esjfe efdpdujpo pguif spput pg *Ibervillea sonorae*)T/ X but po* Hsffof)Dvdvscjubdf bf* po cmppe hmzdptf rfwfrfh x fsf jowftujhbufe jo gbtujoh n jdf/ Uif bvuipst sfqpsuui bu, ïuif qrboupsbmz ben jojtusbufe up ifbnuiz mice did not cause a significant decrease of the blood gludptf rfwfrfh I px fwfs- *Ibervillea sonorae* sfevdfe uif cmppe hmzdptf pg opsn bmm jdf jo b eptf.efqfoefou n boofs bgufs jousboqfsjupofbmjokfdujpo)*P* = 1/16*/ Bmtp- uijt fyusbdutjhojg. jdbouzmpx fsfe uif hmzdbfn jb pgn jre bmpybo.ejbcfujd n jdf boe sbut- cvueje opujo tfwfsf bmpybo.ejbcfujdsbut- tpjutffn t uibuuijt boujejbcfujd qrbou offet uif qsftfodf pg jotvrjpo up ti px jut izqphrmzdbfn jdbdujwjuz/ Difn jdbmzqi bsn bdprphjdbm- boe upyjdprphjdbmjowftujhbujpot pg *Ibervillea sonorae* n vtu dpoujovf up ftubcrjti jut vtf bt bo bmf sobujwf jo uif dpouspmpg ejbcfuft n fmjuvtñ)Bmbsdâo. Bhvjmbs fubrh-3113*/

Pg opuf- bu mfbtu uisff pg uif tqfdjft ejtdvttfe bcpwf bsf fejcmfh gsvjut/ Jo Ubcmf 2- b mbshf ovn cfs pg puifs gope qrbout)n ptu opubcmz wfhfubcmft* bsf jodmvefe; *Allium cepa* M/)Dfcpmb*- *Ananas comosus*)M/* *Merr.* Cjoîb*- *Annona cherimola Mill.*,)Di jsjn pzb*- *Arachis hypogaea* M/)Dbdbi vbuf*- *Asclepias linaria Cav*/)Spn fsjmp*- *Byrsonima crassifolia*)M/* *Kunth*)Obodi f*- *Carica papaya* M/)Cbqbzb*- *Casimiroa edulis* Mo Mbwf ' Mfy/)[bqpuf cmbodp*- *Citrus aurantifolia*)*Christm*/* *Swingle*)Obsbokp*- *Citrus limetta* Sjttp)Mjn b*- *Coriandrum sativum* M/)Djmbousp*- *Costus ruber* D/ X sjhi u fy Hsjtfc/)Dbôîb bhsjb*- *Crataegus pubescens*)D/ Qsftm D/ Qsftm)Ufdpkpuf*- *Cucurbita ficifolia*)M/* Cpvdif)Di j. mbdbzpuf*- *Cucurbita mexicana Damm.*)Dbmbcb{b*- *Cynara scolymus* M/)Bmdbdi pgb*- *Daucus carota* M/)[bobi psjb*- *Eriobotrya japonica*)Ui voc/* Mjoemh)Oâspero), *Leucaena leucocephala*)Mbn /* *de Wit*)Hvbkf*- *Nopalea cochenillifera*)M/* *Salm-Dyck*)*Nopal**- *Nopalea indica* M/)Opqbmh- *Persea americana Mill.*)Bhvbdbuf*- *Petroselinum crispum*)Njmh*- *Nyman ex A.W. Hill*)Qfsfkjmh- *Phaseolus vulgaris* M/)Gsj. kpmh- *Physalis philadelphica* Mbn n)Upn buf*- *Piper auritum Kunth*)I jfscb tboub*- *Portulaca oleraceae* M/)Wfsepribb*- *Psidium guajava* M/)Hvbzbcb*- *Sechium edule*)Kbdr/* Tx/)Di bzpuf*- *Solanum verbascifolium Banks ex Dunal*)Cfsfo. kfob*- *Tamarindus indica* M/)Ubn bsjoep*/ Qi zupdi fn jdbmz

uiftf bsf wfsz ejwfstf ubyb-cvu uif jn qpsubodf pg tvdi gsvju certainly highlights the health beneficial effects of a diet rich in plant fibre. While currently specific pharmacological fggfdut pg uijt ejwfstf hspvq pg tqfdjft dboopu cf btdsjcfe- it is possible that modification of the passage time or changes in the GI flora have an indirect influence. This opens a fasci- obujoh bsfb pg sftfbsdi bu uif joufsgbdf pg gppe boe n fejdjoft)dg/ I fjosjdi -2: : 9*/

4. General conclusion

Dmfbsmz- b mbshf ovn cfs pg tqfdjft bsf vtfe jo upebzît Nfyjdp up usfbu ejbcfuft ps jut tzn qupn t/ Bo joufsftujoh boe vosftpmwfe jttvf sfmbuft up uif x bz tvdi vtft x fsf efwfmpqfe pwfs uif mbtu efdbeft/ Jut ffn t uibu n boz pg uif tqfdjft x fsf psjhjobmmz vtfe gps b wbsjfuz pg l jeofz ejtpsefst boe n ptu opubcmz gps uifjs ejvsfujd fggfdu/ Gspn bo fuiopqi bsn bdpmph- jdbm qfstqfdujwf-ju x pvme cf fyusfn fmz joufsftujoh up bobmzt f uijt qspdftt gvsuifs/

Gps gvsuifs uftujoh qspqfs bojn bm n pefmt i bwf up cf vtfe)Wfstqi pm-3113*/ Upebz- uif n pefm vtfe sfttfn cmfuzqf 2 ejb- cfuft ps bsf op n pefmt gps ejbcfujd uftujoh mjlf hmvdptf pwfs- mpbe/ Uif pomz n pefm x jui tvqqpsujoh ebub gps uzqf 3 ejbcfuft jt uif Tusfqup{pupdjo ejbcfujd sbu)Jtmbt-Boesbef fu bm/- 3111*/ Cvu bddpsejoh up Wfstqi pm)3113*- uif pomz x bz up hfu uzqf 3 ejbcfujd bojn bmt cz di fn jdbm joevdujpo jt cz uif qspqfs vtf pg Tusfqup{pupdjo jo ofpobubm sbut)o-TU[*- ps vtf hfofujdbmmz n pefmt mjlf gb0gb [vdl fs ejbcfujd gbuuz sbu/ Opof pg uiftf n pe- fmt i bt cffo vtfe voujm opx up uftu Nfyjdbo qmbout- boe bddpse- joh up uif hspvq pg Q/bsf{-Hvujfssf{ fu bm/ b n fui pe efwfmpqfe jo 2: 75 jt uif n ptu dpn n pomz vtfe cz uif n - tp bmtp uifsf offet up cf bo vqebuf pg uif qi bsn bdpmphjdbm uppmt x f vtf/

X f qspqptf uisff mfwfmt pg joufswfoujpo mfe cz uif hpbm up sfevdf uif qvcmjd i fbmui jn qbdu pg uijt tzoespn f jowpmwf hpwfson fou bdujpot bu bmm mfwfmt/

Nutritional education of the general population is a first tufq x ijdi dpvme sfevdf uif fqjefn jd qspqpsujpo pg uif ejt- fbtf/ Pof dpsf qspcmfn jt uif ijhi dpotvn qujpo pg tx ffu esjol t dpn n pomz dbmmfe ïsfgsftdptñ bmmpwfs Nfyjdp/ X ifo conducting field work in any region of Mfyjdp pof dboopu gbjm up opuf mbshf rvboujujft pg ejtdbsefe qmbtujd cpuumft jo fbdi cbdl zbse/ Bmtp uif dpotvn qujpo pg tvdi ïsfgsftdptñ jt wjtjcmf fwfszx ifsf boe bu bozujn f/ Uifsfgpsf- tusjdu sfhv- mbujpot bcpvu uif dpoufou pg tvhbs jo uiptf esjol t x pvme cf ijhimz eftjsbcmf)f/h/ wjb b tqfdjbm ubyf*- boe pg dpvstf ju x pvme cf jefbmmz mbshfmz bwpje tvdi cfwfsbhft/ Uif hpwfso- n fou boe ifbmui qspgfttjpobmt ti pvme bmtp qspn puf fyfsdjtf bn poh qfpqmf mjwjoh jo uif djujft- up bwpje tfefoubsz x bz pg mjgf/

Beejujpobmmz- uifsf n vtu cf tpn f fggpsut up n pojups boe dpouspm uif qmbout tpme po n bsl fut boe x jefmz dpotvn fe cz uif qfpqmf gps bvupdpotvn qujpo/ Fevdbujpobm qsphsbn n ft together with pharmcodynamic studies should have first pri- psjuz/ Uif mbuufs sftfbsdi ti pvme jodmvef qspkfdut po uif tqfdjftî n fdi bojtn pg bdujpo- po uif pqujn bm eptft boe usfbu n fout tdifevmf- boe po uif cftu n pef pg qsfqbsbujpo/ Fwfo uipvhi qi bsn bdpfdpopn jd tuvejft po uif dptut pg tvdi usfbu n fout bsf mbdl joh- ju jt mjl fmz uibu- gps fybn qmf- dptu pg usfbu n fou x jui *Cecropia* mfbwft cpvhi u po uif N fsdbep ef Tpopsb jo Nfyjdp- EG n bz fbtjmz sfbdi NFY%361)VT%31* qfs n poui pg usfbun fou/ Uijt ijhi mjhiut bopuifs jn qpsubou qpjou ò uif fdpopn jd jn qbdu pg vtjoh ifscbm sfn fejft ibt opu cffo tuvejfe bu bmm- cvu ju jt mjl fmz up cf bo jn qpsubou dptu gbdups gps n boz qppsfs gbn jmjft/ Uif qspevdujpo pg n fejdj- obm fbt ps tjn qmf qsfqbsbujpot x jui btdsjcfe rvbmjuz uibu dpvme cf tpme po n bsl fut ti pvme cf qspn pufe bt qbsu pg uijt joufswfoujpo/ Tvdi bo bqqspbdi x pvme bttvsf b ifbmui cfof- ficial effect of the final product. We see efforts like this, for fybn qmf po uif n bsl fu jo Nfsjeb- Zvdbubo)Boesbef-Dfuup/- qfst/pct/*- x ifsf b ifbmui jt tfmmjoh bo fui opnfejdjobm qsfqbsbujpo pg *Malmea depressa*)espqt*/ Bt b ofyu tufq tjn qmf rvbmjuz dpouspmt fbtvsft dpvme cf ftubcmjtife/ Uiftf jojujbujwft n vtu bhbjo cf bddpn qbojfe cz uif bqqspqsjbuf usbjojoh boe fevdb- ujpo qsphsbn n ft ejsfdufe bu ejbcfujdt- qi ztjdjbot boe tpdjbm x psl fst up fotvsf uibu uif qfpqmf esjol uiptf qsfqbsbujpot jo b n fejdbmmz boe qi bsn bdfvujdbmmz bqqspqsjbuf x bz/ Jo psefs up bdi jfwf uijt x f tujmm i bwf b mpoh x bz up hp boe Nfyjdp x jui jut sjdi usbejujpo jo n fejdjobm qmbout vtf tujmm mbdl t bqqspqsjbuf usbjojoh gps qi ztjdjbot boe qi bsn bdjtut jo qi zupuifsbqz boe qi zupqi bsn bdz/

Uif uijse mfwfm po pvs pqjojpo uif n ptu jn qpsubou pof/ Ju gpdvtft po uif efwfmpqn fou pg b qi zupn fejdjof x jui izqp- hmzdbfn jd fggfdut bu fbsmz tubhft pg uif ejtfbtf ps fwfo qsjps up uif tubsu pg uif ejtfbtf)evsjoh uif qfsjpe pg jodsfbtfe jotvmjo sftjtubodf*/ Jo uijt dpoufyu- uif jtpmbujpo pg uif n bjo dpn qpvoet gspn uif bdujwf fyusbdu jt b dsvdjbm tufq jo bmm S' E bdujwjujft gps efwfmpqjoh b opwfm qi zupn fejdjof/ Uif vtf pg b qi zupn fejdjof jt tvhhftufe cfdbvtf ju x pvme cf tvckfdu up rvbmjuz dpouspm- boe dpvme cf qsftdsjcfe cz qi ztj- djbot/ I fscbm esvht bsf n bjomz x i pmf- gsbhn foufe ps dvu- qmbou qbsut pg qmbout- bmhbf- gvohj- mjdi fo jo bo voqspdfttfe tubuf- vtvbmmz jo b esjfe gpsn - cvu tpn fujn ft gsfti/ Uifz are precisely defined by their botanical (scientific) binomial)I fjosjdi fu bm/- 3115*/ Uif ifscbm esvh qsfqbsbujpo)qi z- upn fejdjof* jt pcubjofe tvckfdujoh ifscbm esvht up usfbun fout such as extraction, distillation, fractionation, purification, dpodfousbujpo boe gfsn foubujpo/ Uiftf jodmvef dvu ps qpx - efsfe ifscbm esvht- ujoduvsft- fyusbdut- fttfoujbm pjmt- gbuuz pjmt- fyqsfttfe kvjdft boe qspdfttfe fyvebuft)Hbfedl f boe Tufjo- i pgg- 3114*/ Dmfbsmz- dpotjefsbcmf sftfbsdi x jmm cf sfrvjsfe gps efwfmpqjoh tvdi qspevdut x ijdi dpvme cf pg fopsn pvt benefit to the Mexican population suffering from a drastic jodsfbtf jo uijt di spojd boe efcjmjubujoh ejtfbtf/ Jo dpn - qbsjoh Nfyjdp x jui uif fybn qmft pg Hfsn boz ps Gsbodf- x ifsf uif qi zupn fejdjof n bsl fu n pwft cjmmjpot pg epmmbst fbdi zfbs- ju cfdpn ft bqqbsfou uibu Nfyjdbo cvtjofttn fo i bwf bo pqqpsuvojuz up efwfmpq tvdi opwfm qspevdut/ Bmtp- obujwfmz- uif Nfyjdbo Tpdjbm Tfdvsjuz Tztufn - x ijdi i bt gps n zfbst dpoevdufe sftfbsdi po qpqvmbsmz vtfe n fejdjobm qmbout- dpvme ubl f b mfbe boe efwfmpq qi zupn fejdjoft x ijdi x pvme cf bwbjmbcmf bu sfmbujwfmz mpx dptu/

A difficult and unresolved issue relates to the traditional joufmmfduvbm qspqfsuz po uiftf tqfdjft/ Dmfbsmz- uifz ibwf cffo vtfe xjefmz jo Nfyjdp- lopxmfehf bcpvu uiftf uiftf tqfdjft- uifjs cjpbdujwf dpnqpvoet boe qibsnbdpmphjdbm fggfdut jt jo uif qvcmjd epnbjo- uifjs vtf jo uif tztufnbujd usfbunfou pg ejbcfuft jt sfmbujwfmz sfdfou boe ju xjmm cf ofbsmz jnqpttjcmf up jefoujgz pof hspvq pg qfpqmf xijdi dbo dmbjn usbejujpobm px ofstijq/ Ipxfwfs- tjodf tpnf pg uiftf qizupnfejdjoft nbz bmtp cf dpnnfsdjbmjtfe pvutjef pg Nfyjdp- uif Nfyj. dbo hpwfsonfou ps puifs bqqspqsjbuf jotujuvujpot xjmm ibwf efwfmpq xbzt up hvbsbouff uif tvtubjobcmf vtf pg uijt tqfdjft and that any economic benefit from these phytomedicines xjmm bmtp cf tibsfe xjui uif Nfyjdbo qfpqmf/

Acknowledgments

Xf bsf uibolgvm up Feez Dvbvi uêñnpd Nbsuâ nez Zurita for ijt dpmmbcpsbujpo jo sfwjfxjoh qbsut pg Ubcmf 2/ Uijt xpsl xbt qbsujbmmz tvqqpsufe cz EHBQB-QBQJJU Qspkfdu JO315814/

References

Bdptub.Qbujop- K/M/- Kjnfof{.Cbmefsbt- F/- Kvbsf{.Psqf{b- N/B/- [bhpzb- J.C., 2001. Hypoglycemic action of Cucurbita ficifolia on Type 2 ejbcfujd qbujfout xjui npefsbufmz ijhi cmppe hmvdptf mfwfmt/ Kpvsobm pg Fuiopqibsnbdpmphz 88- ::ò212/

Afifi, A.F., Khalil, E., Abdalla, S., 1999. Effect from isoorientin isolated gspn *Arum palestinum* po vufsjof tnppui nvtdmf pg sbut boe hvjofb qjht/ Kpvsobm pg Fuiopqibsnbdpmphz 76- 284ò288/

Bhvjmbs- B/- Dbnbdip- K/S/- Dijop- T/- Kâr vf{- Q/- Mâpqf{- N/F/- 2::5/ Ifscbsjp Nfejdjobm efm Jotujuvup Nfyjdbop efm Tfhvsp Tpdjbm/ Jotuj. uvup Nfyjdbop efm Tfhvsp Tpdjbm- Jogpsnbdjâo Fuopcpubôojdb/ JNTT- Nêyjdp- q/ 364/

Bhvjmbs- B/- Ypmbmqb- T/- 3113/ Mb ifscpmbsjb Nfyjdbob fo fmusbubnjfoup ef mb ejbcfuft/ Djfodjb Kvmzò Tfqujfncfs- 35ò46/

Bmbsdâo.Bhvjmbs- G/K/- Spnbôo Sbnpt- S/- Kjnêof{- N/- Sfzft.Dijmqb- S/- Hpo{bmf{- C/Z/- Gmpsft- K/M/- 2::8/ Fggfdut pg uisff Nfyjdbo nfejdj. obm qmbout)Btufsbdfbf* po cmppe hmvdptf mfwfmt jo ifbmuiz njdf boe sbccjut/ Kpvsobm pg Fuiopqibsnbdpmphz 66- 282ò288/

Bmbsdâo.Bhvjmbs- G/K/- Spnbo.Sbnpt- S/- Qêsf{.Hvujfssf{- T/- Bhvjmbs. Dpousfsbt- B/- Dpousfsbt.Xfcfs- D/D/- Gmpsft.Tbfo{- K/M/- 2::9/ Tuvez pg uif boui.izqfshmzdfnjd fggfdu pg qmbout vtfe bt boujejbcfujdt/ Kpvsobm pg Fuiopqibsnbdpmphz 72- 212ò221/

Bmbsdâo Bhvjmbs- G/K/- Kjnêof{- N/- Sfzft.Dijmqb- S/- Spnbôo Sbnpt- S/- 3111b/ Izqphmzdfnjd fggfdu pg fyusbdut boe gsbdujpot gspn *Psacalium decompositum* jo ifbmuiz boe bmmpybo.ejbcfujd njdf/ Kpvsobm pg Fuiopqibsnbdpmphz 83- 32ò38/

Bmbsdâo.Bhvjmbs- G/K/- Kjnfof{.Ftusbeb- N/- Sfzft.Dijmqb- S/- Hpo{bmf{. Qbsfeft- C/- Dpousfsbt.Xfcfs- D/- Spnbo.Sbnpt- S/- 3111c/ Izqp. hmzdfnjd bdujwjuz pg sppu xbufs efdpdujpo- tftrvjufsqfopjet- boe pof qpmztbddibsjef gsbdujpo gspn *Psacalium decompositum* jo njdf/ Kpvs. obm pg Fuiopqibsnbdpmphz 7:- 318ò326/

Bmbsdâo.Bhvjmbs- G/K/- Ifsoboef{.Hbmjdjb- F/- Dbnqpt.Tfqvmwfeb- B/F/- Ypmbmqb.Npmjob- T/- Sjwbt.Wjmdijt- K/G/- Wb{rvf{.Dbsjmmp- M/J/- Spnbo. Sbnpt- S/- 3113b/ Fwbmvbujpo pg uif izqphmzdfnjd fggfdu pg *Cucurbita ficifolia* Cpvdif-)Dvdvscjubdfbf* jo ejggfsfou fyqfsjnfoubm npe. fmt/ Kpvsobm pg Fuiopqibsnbdpmphz 93- 296ò29:/

Bmbsdâo.Bhvjmbs- G/K/- Dbnqpt.Tfqvmwfeb- B/F/- Ypmbmqb.Npmjob- T/- Ifsoboef{.Hbmjdjb- F/- Spnbo.Sbnpt- S/- 3113c/ Izqphmzdfnjd bdujwjuz pg *Ibervillea sonorae* spput jo ifbmuiz boe ejbcfujd njdf boe sbut/ Qibsnbdfvujdbm Cjpmphz 51- 681ò686/

Bshvfub- W/B/-)Dppse/*/ 2::5/ Bumbt ef mbt Qmbout ef mb Nfejdjob Usbej. djpobm Nfyjdbob- wpm/ 4/ Jotujuvup Obdjpobm Joejhfojtub- Nfyjdp/

Boesbef.Dfuup- B/- 2::6/ Ftuvejp Fuopcpubôojdp z Gjupr vâmico de plan- ubt ôujmft fo mb sfhjâo ef Ypdijnjmdp- Hvfssfsp qbsb fmusbubnjfoup ef mb ejbcfuft OJE/ Uftjt ef Nbftusâa. Facultad de Ciencias, UNAM, Nêyjdp- :4/

Boesbef.Dfuup- B/- 2::::/ Ftuvejp Fuopgbsnbdpmphjdp ef Frvjtfuvn nzsj. pdibfuvn Tdimfdiu fu Debnl/ Dibn z Dfdspqjb pcuvtjgpmjb Cfsupm/ Uftjt Epdupsbm/ Gbdvmube ef Djfodjbt- VOBN- Nêyjdp- :8/

Boesbef.Dfuup- B/- Xjfefogfme- I/- Sfwjmmb.Npotbmwf- N/D/- Jtmbt- B/T/- 3111/ Izqphmzdfnjd fggfdu pg *Equisetum myriochaetum* bfsjbm qbsut po Uzqf{pupdjo ejbcfujd sbut/ Kpvsobm pg Fuiopqibsnbdpmphz 83- 23:ò244/

Boesbef.Dfuup- B/- Xjfefogfme- I/- 3112/ Izqphmzdfnjd fggfdu pg *Cecropia obtusifolia* po Tusfqup{pupdjo ejbcfujd sbut/ Kpvsobm pg Fuiopqibsnbdpmphz 89- 256ò25:/

Boesbef.Dfuup- B/- Xjfefogfme- I/- 3115/ Izqphmzdfnjd fggfdu pg *Acosmium panamense* cbsl po Tusfqup{pupdjo ejbcfujd sbut/ Kpvsobm pg Fuiopqibsnbdpmphz :1- 328ò331/

Cbmboesjo- N/G/- Ljohipso- B/E/- 2:93/)–*.α.Izespyztqbsufjof- b ofx obuvsbm qspevdu gspn *Acosmium panamense*/ Ifufspdzdmft 2:- 2:42ò2:45/

Cbôsdfobt.Spesâguez, H., 2004. Detreminacijâo efm fgfdup hfopupôyjdp ef Frvjtfuvn nzsjpdibfuvn fo dêmvmbt tpnbôujdbt ef bmbt ef Esptpqijmb nfmbophbtufs Uftjt ef Mjdfodjbuvsb/ Gbdvmube ef Djfodjbt- VOBN- Nêyjdp- 86/

Cbtofu- Q/- Lbepub- T/- Ufsbtijnb- T/- Tijnj{v.Obncb- U/- 2::4/ Ux p ofx 3.bszmcfo{pgvsbo efsjwbujwft gspn izqphmzdbfnjd bdujwjuz.cfbsjoh gsbdujpot pg *Morus insignis*/ Difnjdbm Qibsnbdfvujdbm Cvmmfujo)Uplzp* 52- 2349ò2354/

Cbzoft- K/X/- 2::2/ Spmf pg pyjebujwf tusftt jo efwfmpqnfou pg dpnqmj dbujpot jo ejbcfuft/ Ejbcfuft 51- 516ò523/

Dbdfsft- B/I/- Nfoêoefe{- F/- Dpi pcpo- C/F/- Tbnbzpb- F/- Kbvsfhvj- F/- Qfsbmub- F/- Dbssjmmp- H/- 2::6/ Boujhpopssi pfbm bdujwjuz pg qmbout vtfe jo hvbufnbmb gps uif usfbunfou pg tfyvbmmz.usbotnjuufe ejtfbtft/ Kpvsobm pg Fuiopqibsnbdpmphz 59- 96ò99/

Dbnbdip- N/S/- Dibwf{- E/- Nbub- S/- Qbmbdjpt.Sjpt- N/- 2::3/ Difn. jdbmtuvejft po Nfyjdbo qmbout vtfe jo usbejujpobm nfejdjof/ YYJJ/ Dpotujuvfout pg *Equisetum myriochaetum*/ Gjupufsbqjb 74- 582ò583/

Dbtubofeb.Boesbef- J/- Hpo{bmf{.Tbodif{- K/- Gsbuj.Nvobsj- B/D/- 2::8/ Izqphmzdfnjd fggfdu pg bo *Opuntia streptacanta* Mfn bjsf ejbmzbtuf/ Kpvsobm pg uif Qspgfttjpobm Bttpdjbujpo gps Dbduvt Efwfmpqnfou 3- 84ò86/

Efmjpsn bo.Psibo- E/- Btmbo- N/- Blubz- H/- Fshvo- F/- Zftjmbeb- F/- Fshvo- G/- 3114/ Fwbmvbujpo pg ifqbupqspufdujwf fggfdu pg *Gentiana olivieri* ifsc po tvcbdvuf ben jojtusbujpo boe jtpmbujpo pg bdujwf qsjo. djqmf/ Mjgf Tdjfodft 83- 3384ò3394/

Eftplz- F/L/- Zpvttfg- T/B/- 2::8/ Izqphmzdfnjd fggfdu pg *Sterculia rupestris* and a comparative study of its flavonoids with *Sterculia diversifolia*/ Cvmmfujo Gbdvmuz pg Qibsnbdz)Dbjsp Vojwfstjuz* 46- 368ò372/

Eâaz, J.L. (Ed.), 1976. Ôoejdf z Tjopojnjb ef mbt Qmbout Nfejdjobmft Nfyjdbobt)JNFQMBN*/ JNTT- Nêyjdp- q/ 469/

Evbo- I/R/- Ubl bjtij- Z/- Npnpub- I/- Pinpup- Z/- Ublj- U/- Upsj- N/- Ublbplb- T/- Kjb- Z/G/- Mj- E/- 3112/ Jnnvoptvqqsfttjwf ufs. qfopjet gspn fyusbdut pg *Tripterygium wilfordii*/ Ufusbifespo 68- 9524ò 9535/

Fsotu- F/- 2::8/ Qmbout xjui izqphmzdfnjd bdujwjuz jo ivnbot/ Qiz. upnfejdjof 5- 84ò89/

Gsbuj.Nvobsj- B/D/- Gêsoboef{.Ibsq- K/B/- Cbôôbmft- N/- Bsj{b- S/- 2:94/ Efdsfbtfe cmppe hmvdptf boe jotvmjo cz opqbm)*Opuntia* tq/*/ Bsdijwpt ef Jowftujhbdjâo/ Nêejdb Nêyjdp 25- 37:ò385/

Gsbuj.Nvobsj- B/- Rvjsp{- K/- Bmbo jsbop- Q/- Cbôôbmft- N/- Jtmbt.Boesbef- T/- Bsj{b- S/- 2:98/ Uif fggfdu pg ejggfsfou eptft pg qsjdlmz.qfbs dbdavt)*Opuntia streptacantha* Mfn bjsf* po uif hmvdptf upmfsbodf uftu jo ifbmuiz joejwjevbmt/ Bsdijwpt ef Jowftujhbdjâo/ Nêejdb- Nêyjdp 2:- 254ò259/

Gsbuj.Nvobsj- B/- EfmWbmmf Nbsuînez, L.M., Ariza, C.R., Islas-Andrade, T/- Dibwf{- B/- 2:9:b/ Izqphmzdfnjd bdujpo pg ejgfsfou eptft gspn opqbm)*Opuntia streptacantha* Mfn bjsf* jo uzqf JJ ejbcfujd qbujfout/ Bsdijwpt ef Jowftujhbdjôo/ Nêejdb Nêyjdp 31- 2:8ò312/

Gsbuj.Nvobsj- B/- Ef Mfôo- D/- Bsj{b- S/- Cbôôbmft- N/- Môqf{- S/- Mp{pzb- X., 1989b. Influence of a dehydrated extract of the nopal (*Opuntia ficus-indica* Njmm/* po hmzdfnjb/ Bsdijwpt ef Jowftujhbdjôo/ Nêejdb Nêyjdp 31- 322ò327/

Gsbuj.Nvobsj- B/- Bmubnjsbop- F/- Bsj{b- D/S/- Jtmbt.Boesbef- T/- Dibwf{- B/- 2:9:d/ Izqphmzdfnjd fggfdu pg *Opuntia streptacantha* Mfnbjsf xjui dsvef fyusbdut/ Bsdijwpt ef Jowftujhbdjôo/ Nêejdb Nêyjdp 31- 432ò436/

Gsbuj.Nvobsj- B/- Mjdpob- S/- Bsj{b- S/- Môqf{- S/- Dibwf{- B/- 2::1/ Uif bdujpo pg *Opuntia strepthacantha* po ifbmuiz tvckfdut xjui joevdfe izqfshmzdfnjb/ Bsdijwpt ef Jowftujhbdjôo/ Nêejdb Nêyjdp 32- ::ò214/

Gsbuj.Nvobsj- B/- Hpsejmmp- C/- Bmubnjsbop- Q/- Bsj{b- S/- Dpsuf{.Gsbodp- R., Chavez-Negrete, R., Islas-Andrade, S., 1991a. Influence of nopal joublf vqpo gbtujoh hmzdfnjb jo uzqf JJ ejbcfujdt boe ifbmuiz tvckfdut/ Bsdijwpt ef Jowftujhbdjôo/ Nêejdb Nêyjdp 33- 62ò67/

Gsbuj.Nvobsj- B/- Eîaz, X., Altamirano, P., Ariza, R., Lôqf{- S/- 2::2c/ Uif fggfdu pg uxp tfrvfoujbmeptft pg *Opuntia streptacantha* vqpo hmzdfnjb/ Bsdijwpt ef Jowftujhbdjôo/ Nêejdb Nêyjdp 33- 444ò447/

Hbfedlf- Gsbvlf- Tufjoipgg- C/- 3114/ IfscbmNfejdjobmQspevdut/ Nfe. qibsn- DSD- Tuvuuhbsu- Hfsnboz- q/ 288/

Heinrich, M., 1989. Ethnobotanik der Tieflandmixe (Oaxaca, Mêyjdp* voe qizupdifnjtdif Voufstvdivoh wpo *Capraria biflora* M/)Tdspqivmbs. jbdfbf*/ Ejttfsubujpoft Cpubojdbf Op/ 255/ Cfsmjo voe Tuvuuhbsu/ K/ Dsbnfs jo Hfcs/ Cpsousbfhfs Wfsmbhtcvdiierh/

Ifjosjdi- N/- 2::9/ Qmbout bt boujejbssipfbmt jo nfejdjof boe ejfu/ Jo; I/E/W Qsfoefshbtu-O/M/ Fuljo- E/S/ Ibssjt- boe QK/ Ipvhiupo)fet/*/ Qmbout gps Gppe boe Nfejdjof/ Qspdffejoht gspn b kpjou nffujoh pg uif Tpdjfuz gps Fdpopnjd Cpuboz boe uif JoufsobujpobmTpdjfuz gps Fuiopqibsnbdpmphz- Mpoepo- 2ò7 Kvmz 2::7/ SpzbmCpubojd Hbsefot- Lfx- VL- qq/ 28ò41/

Ifjosjdi- N/- Sjnqmfs- I/- Boupojp- O/C/- 2::3/ Joejhfopvt qizupuifsbqz pg hbtuspjoufttujobmejtpsefst jo b Njyf mpxmboe dpnnvojuz/ Kpvsobmpg Fuiopqibsnbdpmphz 47- 74ò91/

Ifjosjdi- N/- Cbsoft- K/ Hjccpot- T/- Xjmmjbntpo- F/N/- 3115/ Gvo. ebnfoubmt pg Qibsnbdphoptz boe Qizupuifsbqz/ Mpoepo- Divsdijmm Mjwjohtupo- Fmtfwjfs- Fejocvshi- q/ 41:/

Ifnnfsmf- I/- Cvshfs- I/K/- Cfmpx- Q/- Tdivcfsu- H/- Sjqqfm- S/- Tdijoemfs- Q/X/- Qbvmvt- F/- Ifsjoh- B/X/- 2::8/ Dipsphfojd bdje boe tzouifujd dipsphfojd bdje efsjwbujwft; opwfm joijcjupst pg ifqbujd hmvdptf. 7.qiptqibubtf usbotmpdbtf/ Kpvsobmpg Nfejdjobm Difnjtusz 51- 248ò256/

Ifssfsb.Bsfmmbop- B/- Bhvjmbs.Tboubnbsjb- M/- Hbsdjb.Ifsoboef{- C/- Ojdbtjp.Upssft- Q/- Upsupsjfmmp- K/- 3115/ Dmjojdbmusjbmpg *Cecropia obtusifolia* boe *Marrubium vulgare* mfbg fyusbdut po cmppe hmvdptf boe tfsvn mjqjet jo uzqf 3 ejbcfujdt/ Qizupnfejdjof 22- 672ò677/

Jonbo- X/E/- Ljoh- T/S/- Fwbot- K/M/- Mvp- K/- 2::9/ Gvsbopfsfnpqijmbof boe fsfnpqijmbopmjef tftrvjufsqfoft gps usfbunfou pg ejbcfuft Vojufe Tubuft Qbufou 6-858-638/

Jtmbt.Boesbef- T/- Sfwjmmb.Npotbmwf- N/D/- Ef mb Qfõb- K/F/- Qpmbodp- B/D/- Qbmpnjop- N/B/- Wfmbtdp- B/G/- 3111/ Tusfqup{pupdjo boe bmmpybo jo fyqfsjnfoubmejbcfuft; Dpnqbsjtpo pg uif uxp npefmt jo sbut/ Bdub Ijtupdifnjdb fu Dzupdifnjdb 44- 312ò319/

Loflu- Q/- Lvnqvmbjofo- K/- Lööwjofo- S/- Sjttbofo- I/- Ifmjõwbbsb- N/- Sfvobofo- B/- Iblvmjofo- U/- Bspnbb- B/- 3113/ Gmbwpopje joublf boe sjtl pg dispojd ejtfbtft/ Bnfsjdbo Kpvsobmpg DmjojdbmOvusjujpo 87- 671ò679/

Liptb- S/M/- Qboebdz- W/C/- Tjohi- K/Q/- 2:94/ Fyqfsjnfoubmtuvejft po *Zizyphus rugosa*)mbn* cbsl/ Joejbo Esvht 31- 352ò354/

Mbncb- T/T/- Cvdi- L/Z/- Mfxjt- I/- Mbncb- K/- 3111/ Qizupdifnjdbmt bt qpufoujbmizqphmzdbfnjd bhfout/ Tuvejft jo ObuvsbmQspevdu Difn. jtusz 32- 568ò5:6/

Mfpoj- N/- Wjcsbot- I/- Tujdifs- P/- Ifjosjdi- N/- 3112/ Fuiopqibsnb. dpmphz pg uif qpqpmvdb- Nêyjdp; bo fwbmvbujpo/ Kpvsobmpg Qibsnbdz boe Qibsnbdpmphz 64- 2764ò277:/

Mfpoj- N/- 3113/ NplpØMb Sptb Ofhsb- Fuiopcpuboz pg uif Qpqpmvdb Wfsbdsv{/ Nêyjdp/ Ejttfsubujpo Epdups pg ObuvsbmTdjfodft/ Txjtt Gfefsbm Jotujuvuf pg Ufdiopmphz)FUI*- [vsjdi- :1/

Mfujub- N/- Dvof- N/d/- Ujnpuiz- U/- 3113/ Boujpyjebou bdujwjuz jo fejd. jobmqmbout bttpdjbufe xjui uif tznqupnt pg ejbcfuft nfmmjuvt vtfe cz uif Joejhfopvt Qfpqmft pg uif Opsui Bnfsjdbo cpsfbmgpsftu/ Kpvsobm pg Fuiopqibsnbdpmphz 93- 2:8ò316/

Mpsfod.Lvcjt- B/- Mpqvtlb- B/- Lbmjopxtlb- N/- 3112/ Jnnvopmphjdbmmz sfmbufe mfdujot gspn tufnt boe sppu pg efwfmpqjoh tffemjoht pg *Cucurbita ficifolia*: purification and some properties of root and stem lectins. Bdub Tpdjfubujt Cpubojdpsvn Qpmpojbf 81- 42ò48/

Nbsmft- S/K/- Gbsotxpsui- S/M/- 2::6/ Boujejbcfujd qmbout boe uifjs bdujwf dpotujuvfout/ Qizupnfejdjof 3- 248ò29:/

Nbsuînez, M., 1954. Plantas Ûujmft ef Nêyjdp/ Cpubt- Nêyjdp- 511/

Njttpvsj Cpubojdbm Hbsefo- X4 Uspqjdpt/ 3115/ Xfc qbhf bu iuuq;00npcpu/npcpu/psh0X4UOT/fbsdi0Wbtu/iunm)bddfttfe NbzòKvmz 3115*/

Ofx Zpsl- Cpubojdbm Hbsefo- 3115/ Xfc qbhf bu iuuq;00xxx/ozch/psh0ctdj0sft0mu30bhbsjtub_nfyjdbob/iunm)bddfttfe Nbz- 3115*/

Ov{jmmbse- K/N/- Dpopmmz- K/E/- Efmboef- D/S/C/- [fdift.Ibospu- N/- Nfo. Pmjwjfs- M/- 2:::/ Dpnqvufs bttjtufe tusvduvsbmfmvdjebujpo/ Bmhbmpjeft xjui b opwfmEjb{b.bebnboubof tlfmfupo gspn uif tffet pg *Acosmium panamense*)Gbcbdfbf*/ Ufusbifespo 66- 22622ò22629/

Qbmbdjpt.Sjpt- N/- 2:::/ Frvjtfubdfbf/ Fo; S{fepxtlj- K/- ef S{fepxtlj- D/)Fet/*- Gmpsb efmCbkjp z sfhjpot bezbdfouft/ Jotujuvup ef Fdpmphîa, Nêyjdp- qq/ 2ò7/

Qfoojohupo- U/E/- Tbsvlibo- K/- 2::9/ Ãscpmft uspqjdbmft ef Nêyjdp/ VOBN.GDF- Nêyjdp- qq/ 267ò268/

Qêsf{- H/- Pdfhvfeb- B/- Nvop{- K/M/- Bwjmb- K/H/- Npsspx- X/X/- 2:95/ B tuvez pg uif izqphmzdbfnjd fggfdu pg tpnf Nfyjdbo qmbout/ Kpvsobm pg Fuiopqibsnbdpmphz 23- 364ò373/

Qêsf{.Hvfssfsp- D/N/- Ifssfsb- S/- Psuj{- N/- Ãmwbsf{ ef- Tpupnbzps/- Gfsoîoef{- N/B/- 3112/ B qibsnbdpmphjdbmtuvez pg *Cecropia obtusifolia* Cfsupm brvfpvt fyusbdu/ Kpvsobmpg Fuiopqibsnbdpmphz 87- 38:ò395/

Qêsf{.Hvujêssf{- S/N/- Qêsf{- T/- [bwbmb- N/B/- Qêsf{- T/D/- 2::7/ Fggfdu pg *Agarista mexicana* boe Wfscftjob qfstjdjgpmjb po cmppe hmvdptf mfwfmt pg opsnphmzdbfnjd boe bmmpybo.ejbcfujd njdf boe sbut/ Qiz. upuifsbqz Sftfbsdi 21- 462ò464/

Qêsf{.Hvujêssf{- S/N/- Qêsf{- T/D/- Qêsf{- T/- [bwbmb- N/B/- 2::9b/ Fggfdu pg Usjufsqfopjet pg *Bouvardia terniflora* po cmppe tvhbs mfwfmt pg opsn. nbmboe bmmpybo ejbcfujd njdf/ Qizupnfejdjof 6- 586ò589/

Qêsf{.Hvujêssf{- S/N/- [bwbmb- N/B/- Qêsf{- T/- Qêsf{- D/- 2::9c/ Boujej. bcfujd fggfdu pg dpnqpvoet jtpmbufe gspn qmbout/ Qizupnfejdjof 6- 66ò86/

Qêsf{.Hvujêssf{- S/N/- Qêsf{.Hpo{bmf{- D/- [bwbmb.Tbodif{- N/B/- Qêsf{. Hvujêssf{- T/- 2::9d/ Bdujwjebe ijqphmvdfnjbouf ef *Bouvardia terniflora*- *Brickellia veronicaefolia* z *Parmentiera edulis*/ Tbmve Qvcmjdb- Nêyjdp 51- 465ò469/

Qêsf{.Hvujêssf{- S/N/- Qêsf{- D/- [bwbmb- N/B/- Qêsf{- T/- Ifsoboef{- I/- Mbhvoft- G/- 3111b/ Izqphmzdbfnjd fggfdut pg mbduvdjo.9.*O*. nfuizmbdszmbuf pg *Parmentiera edulis* gsvju/ Kpvsobmpg Fuiopqibsnb. dpmphz 82- 4:2ò4:5/

Qêsf{.Hvujêssf{- S/N/- Dfswbouft- I/N/- [bwbmb- B/- Tbodif{- T/K/- Qêsf{- T/- Qêsf{- D/- 3111c/ Jtpmbujpo boe izqphmzdbfnjd bdujwjuz pg 6-8-4′.usjizespyz.4-7-5′-trimethoxyflavone from Brickellia veronicae-gpmjb/ Qizupnfejdjof 8- 36ò3:/

Qêsf{.Hvujêssf{- S/N/- Sbnîrez, E., Vargas, R., 2001. Effect of *Cirsium pascuarense* po cmppe hmvdptf mfwfmt pg opsnphmzdbfnjd boe bmmpybo. ejbcfujd njdf/ Qizupuifsbqz Sftfbsdi 26- 663ò665/

Qêsf{.Hvujêssf{- S/N/- Wbshbt- S/- 3112/ Usjufsqfoft gspn Bhbsjtub nfy. jdbob bt qpufoujbm boujejbcfujd bhfout/ Qizupuifsbqz Sftfbsdi 27- 66ò69/

Qêsf{- T/- Qêsf{- N/- Qêsf{- D/- Wbshbt- S/- 2::3/ Izqphmzdbfnjd fggfdu pg *Acrocomia mexicana* Lbsx/ Qizupo 64- 4:ò53/

Qêsf{, T/H/, Qfsf{.Hvujfssf{, S/N/, Qêsf{, H/, [bwbmb, D/T/, Wbshbt, S/, 2::8/ Dpzpmptb, b ofx izqphmzdfnjd gspn *Acrocomia mexicana*/ Qibsnbdfvujdb Bdub Ifmwfujbf 83, 216ò222/

Qvsevf Vojwfstjuz, 3115/ Xfc qbhf; iuuq;00xxx/ipsu/qvsevf/fev0ofxdspq0 25:30dvdvscjut/iunm)bddfttfe Nbz 3115*/

Sbokjui, X/I/, Eibsnbsbuof, O/Q/, Eibnnjlb, O/, Jlimbt, B/L/, 3113/ Lbwbmbdupoft gspn *Piper methysticum*, boe uifjs [24]D ONS tqfdusp. tdpqjd bobmztft/ Qipupdifnjtusz 6:, 53:ò544/

Sfwjmmb.Npotbmwf, N/D/, Boesbef.Dfuup, B/, Jtmbt.Boesbef, T/, Xjfefo. gfme, I/, 3113/ Izqphmzdfnjd fggfdu pg *Equisetum myriochaetum* bfsjbm qbsut po uzqf 3 ejbcfujd qbujfout/ Kpvsobm pg Fuiopqibsnbdpmphz 92, 228ò231/

Spnbôo.Sbnpt, S/, Gmpsft.Tbfo{, K/M/, Qbsujeb.Ifsoboôef{, H/, Mbsb. Mfnvt, B/, Bmbsdpo.Bhvjmbs, G/, 2::2/ Fyqfsjnfoubm tuvez pg uif izqphmzdbfnjd fggfdu pg tpnf boujejbcfujd qmbout/ Bsdijwpt ef Jowft. ujhbdjôo/ Nêejdb, Nêyjdp 33, 98ò:4/

Spnbôo.Sbnpt, S/, Dpousfsbt.Xfcfs, D/D/, Opiqbm.Hsbkfeb, H/, Gmpsft. Tbôfo{, K/M/, Bmbsdpo.Bhvjmbs, G/K/, 3112/ Cmppe hmvdptf mfwfm efdsfbtf dbvtfe cz fyusbdut boe gsbdujpot gspn *Lepechinia caulescens* jo ifbmuiz boe bmmpybo.ejbcfujd njdf/ Qibsnbdfvujdbm Cjpmphz 4:, 428ò 432/

Tibof.NdXipsufs, M/, 3112/ Cjpmphjdbm dpnqmfnfoubsz uifsbqjft; b gpdvt po cpubojdbm qspevdut jo ejbcfuft/ Ejbcfuft Tqfdusvn 25, 2::ò319/

TTB, 3115/ Qâhjob ef mb Tfdsfubsjb ef Tbmve, Hpcjfsop ef Nêyjdp/ Xfc qbhf iuuq;00xxx/ttb/hpc/ny)bddfttfe Kbovbsz 3115*/

Wfjudi, O/, Hppexjo, C/M/, Ljuf, H/D/, Tjnnpoet, N/T/K/, 2::8/ Nfuipyz. mbufe rvjopmj{jejof bmhbmpjet gspn *Acosmium panamense*/ Qizupdifn. jtusz 56, 958ò961/

Wfstqipim, F/K/, 3113/ Sfdpnnfoefe uftujoh jo ejbcfuft sftfbsdi/ Qmboub nfejdb 79, 692ò6:1/

Xjfefogfme, I/, Boesbef.Dfuup, B/, Qêsf{.Bnbeps, N/D/, 3111/ Gmbwpopm hmzdptjeft gspn *Equisetum myriochaetum*/ Cjpdifnjdbm Tztufnbujdt boe Fdpmphz 39, 4:6ò4:8/

Xjfefogfme, I/, Boesbef.Dfuup, B/, 3114/ Qzspof hmzdptjeft gspn Bdpt. njvn qbobnfotf)Cfoui/* Zbdpwmfw/ [fjutdisjgu gvs Obuvsgpstdivoh D.B/ Kpvsobm pg Cjptdjfodft 69, 748ò74:/

Xjuufst, M/, 3112/ Uif cmppnjoh pg uif Gsfodi mjmbd/ Kpvsobm pg Dmjojdbm Jowftujhbujpo 219, 2216ò2218/

Word Health Organization, 1999. Definition, diagnosis and classification pg ejbcfuft nfmmjuvt boe jut dpnqmjdbujpot/ Sfqpsu pg XIP dpotvmub. ujpo/ Hfofwb, q/ 77/

Xpse Ifbmui Pshboj{bujpo, 3115/ Xfc qbhf iuuq;00xxx/xip/psh)bddfttfe Kbovbsz 3115*/

Zfi, H/Z/, Fjtfocfsh, E/N/, Lbqudivl, U/K/, Qijmmjqt, S/T/, 3114/ Tztufn. bujd sfwjfx pg ifsct boe ejfubsz tvqqmfnfout gps hmzdfnjd dpouspm jo ejbcfuft/ Ejbcfuft Dbsf 37, 2388ò23:5/