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USEFUL SPECIES TO OBTAIN PHYTOESTROGENS IN THE BIOSPHERE RESERVE "BUENAVISTA", CUBA

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Abstract

An etnobotanical study was made at the Biosphere Reserve Buenavista in order to identify species which are used there by people for climacteric symptoms. These species could have phytoestrogenic effect and these plants could be used in the industry to obtain natural products for medical problems. A total of 36 clearly distinguishable species were registered. They belong to 25 botanical families. The botanical families that have more species are Rosaceae and Malvaceae. The species with greater diversity of use are Annona squamosa, Mangifera indica and Psidium guajava. The uses which are reported can be defined as follows: anticancer [12], belly diseases [10], cardiovascular affections [7], inflammation [6], menopause [5], abortive [5], regulation of menstruation [5], diseases of the genital organs [5] and arterioesclerosis [1].

Key Words: Medicinal plants, phytoestrogens, climacteric period, forestry products, use of plants, Biosphere Reserve Buenavista, Cuba.

Introduction

Etnobotany is a branch of science which covers the study and interpretation of the knowledge, the cultural significance, the handling and the traditional use of flora or plant life elements [1]. Investigation and study in this field of science allow us to identify the use which man has attributed traditionally to the various elements of the vegetal diversity. It enables us to identify them and make an inventory of the useful flora of a region or country and get acquainted with the several species and their potential of exploitation in industry, particularly in the medical and pharmaceutical sector.

The Biosphere Reserves are areas with great biological values and a certain degree of conservation [2], where several studies are carried out trying to bring into a survey the cultural and traditional treasure of its plants into order to facilitate the conservation of its vegetal resources. [3, 4] "Buenavista" is located in the central northern part of the provinces of Villa Clara, Sancti Spíritus y Ciego de Ávila, with a surface of 313, 502 hectares. We come across the Evergreen Forest, the Mangrove Forest, the Xeromorphic Scrub Coastal and Subcoastal, The Scrub on Sandy Coasts, the Vegetation Complex of Rock Coasts, the Vegetation Complex of Sandy Coasts, the Semideciduous Forest and Secondary Vegetation [2]. All these are of great importance for the presence of medicinal plants used by the farmers. Results obtained in the "Península de Guanahacabibes" have proved the existence of species potentially useful for the acquisition of phytoestrogens [5].

The work and study objective was the identification of those vegetal species which possess the potential to be exploited as natural sources of phytoestrogens in the Biosfera Reserve Buenavista. The starting point was the medicinal use provided by the population using the plants for complaints and diseases related with the climacteric period. These results can be applied at the level of forest management and conservationist activity.

Materials and Methods

In the months of February, June and Octobre 2005 an etnobotanic study was carried out together with 38 collectors of medicinal plants in the locations of Mayajigua, Obdulio Morales, Simón Bolívar, Yaguajay, Centeno y Nela, in the Biosfera (Fig. 1). 71 % of the interviewees were women and the average age was 61. The Delegation of the Ministry of Science, Technology and Environment of the province of Sancti Spiritus provided the entrance to the locations and the users of useful plants.

The obtained information was linked with the inventory of the medicinal plants used for the biological processes related to the menopause or the climacteric period. The study also included diseases and complaints associated with the menopause, on which the phytoestrogens had shown to have a positive effect. Basic questions were asked such as: which are the medicinal plants used to alleviate the ailments of the menopause, cardiovascular disorders, arterioesclerosis and anticancer effect? Which parts of the species should be used, flowers, leaves, roots, etc? Where do we find these species, in vegetable gardens, orchard, forest, bushes?

The following activities have been carried out: a) informal interviews [6, 7] in order to have a general view on aspects of the use of certain species of plants, b) participative workshops [8] with maps to identify collection zones of certain species, their names in local vernacular and the indication of temporal and historical patterns in order to know when the use of the various species started and how it has continued down the years, c) participating observation in the activity of the collection of the plants.

The medicinal plants were identified by specialists of the Herbario Nacional Onaney Muñiz of the Institute of Ecology (Instituto de Ecología y Sistemática) and were updated according to Acevedo and Strong [9]. The samples were collected following the criteria of Lot and Chiang [10] and placed into the herbarium of the latter insitute.

In order to determine the level of similarity between the reported uses for the species, a many-sided analysis was carried out. For that purpose a similarity matrix was developed, in which the variables (columns) were the medicinal uses and the observations (rows) correspond with the species. The matrix shows the presence or absence of each species with its specific reported use. (Appendix 1)

Results and Discussion

Based on the informal interviews, workshops and observations, a total of 36 species were listed belonging to 25 botanic families which show a potential phytoestrogenic activity. (Table 1) Eight botanic families emerge as most useful. Among them the Euphorbiaceae are the most important with three [3] species, *Kalanchoe brasiliensis, Manihot esculenta and Ricinnus communis.*

The latter one is the only one which could be found in the wild state. Collecting *Rauwolfia salicifolia* for medicinal purposes has been prohibited for more than five [5] years because it is endemic species. The herbacea species prevail [14], followed in decreasing order by trees [11] and bushes [11].

The farmers reported nine [9] categories of medical use. They are: anticancer [12], belly diseases [10], cardiovascular affections [7], inflammations [6], abortive [5], diseases of the genital organs [5], menopause [5], regulation of the menstrual period [5], arterioesclerosis [1] (Table 2, Fig. 2). The uses coincide with the reports by Rosete et. al. (2006) for the Biosfera Reserve of the Peninsula de Guanahacabibes. In all reported uses the parts of the plants the leaves and the seeds are used most frequently (Fig. 3). These results allow us to guarantee a sense of conservation of the natural resources.

The phenogram (Fig. 4) shows the level of similarity among the several uses. It also shows the division into two large groups which diverge at a low level of similarity into one which is solely anticancer (AC) and an other one for the belly diseases (BD), cardiovascular affections (CF), abortive (AB), diseases of the genital organs (GO), inflammations (IN), menopause (MN), regulation of menstrual period (RM) and arteriosclerosis (AR). The latter group in its turn can be subdivided into two subgroups, one which is made up of CF, AB, RM, IN, MN and AR. They show distinctive grades of similarity according to different levels of similarity that support them. There is a very close relationship between MN and AR because only *Cocos nucifera* shows both antropocentric categories. IN overlaps this relationship as it has a certain link with both MN and AR. It shares the *Capraria biflora* species with MN, but *Commelina elegans, Kalanchoe brasiliensis* and *Solanum nigrum* are exclusive for IN. AB and RM share two species, *Ceiba pentandra* and *Persea americana,* but they differ in the respect that the first one (AB) was reported to include *Hibicus rosa-sinensis, Trichilia hirta* and *Ricinnus communis* and the second one (RM) was reported to include *Citrus aurantium*. *Melia azederach, Pelargonium graveolen* and *Rauwolfia salicifolia* only belong to CF, which has a link with the rest of the group through the *Jasminus grandifolium.* The other subgroup formed by BD and GO, shares the species *Catharanthus roseus* y *Carica papaya*, but BD was reported for Spermacoce tenuior, Turnea ulmifolia, Crescentia cujete, Turnea ulmifolia. *Canella winteriana y Eugenia floribunda* was reported for GO. Both subgroups are linked by the species *Capraria biflora* and *Plantago major.* The group AC is exclusively characterized by *Allium cepa, Manihot esculenta, Musa x paradisiaca, Ocimun bacilicum* and *Ocimun sanctus* and *Petiveria alliacea*. The relationship between both groups is given in the classification of the organisms (taxon) *Alloe vera, Annona squamosa, Capsicum annuun, Carica papaya, Morinda citrifolia* and *Psidium guajava*.

Duke and Bogenschutz (2003) discovered 11 compounds with oestrogenic activity in 22 species reported by the population. These are the beta-sitosterol (13 species), quercetin [11], borón [10], kaempferol [8], stigmasterol [4], coumarin [3], anethole [2], apigenin [2], luteolin [2], diosgenin [1], naringenin [1]. There are 5 species which have a great number of compounds: *Ocimum bacilicum* [8], *Musa x paradisiaca* [5], *Persea americana* var. *americana* [4], *Allium cepa* [4], *Ricinnus communis* [4].

Conclusion

The species which are potentially useful for the obtain of phytoestrogens in the Biosfera Reserve Buenavista are classified into 36 infrageneric taxa. The botanical families which are most present, are: Apocinaceae, Euphorbiaceae, Lamiaceae, Malvaceae, Meliaceae, Myrtaceae, Rubiaceae y Solanaceae.

The uses reported are anticancer [12], belly diseases [10], cardiovascular affections [7], inflammation [6], menopause [5], abortive [5], regulation of menstrual period [5], diseases of the genital organs [5] and arterioesclerosis [1].

The species with the most diverse use are *Annona squamosa, Mangifera indica* y *Psidium guajava.*

They have discovered 22 species which have been proved to contain chemical compounds with estrogenic activity.

Reference

1. Barrera H. La Etnobotánica: Tres puntos de vista y una perspectiva. INIRES, Xalapa, Veracruz, México 1979; 30 pp.
2. Herrera M. Reservas de la Biosfera de Cuba. Programa El Hombre y la Biosfera (MaB) de la UNESCO. Ed. EGRAFIP. La Habana, Cuba 2001; 57 pp.
3. Rosete S, Ricardo N, Herrera P., López A. Etnobotánica en la Reserva de la Biosfera Península de Guanahacabibes, Cuba. Acta Botánica Cubana 2011 (a); 211: 29-35.
4. Rosete S, Ricardo N, Herrera P, Rodríguez L, Hernández A. Plantas medicinales en la Reserva de la Biosfera Península de Guanahacabibes, Pinar del Río, Cuba. Acta Botánica Cubana 2011 (b); 211: 36-41.
5. Rosete S, Guzmán Y, Herrera P, Green G, González A.

la obtención de fitoestrógenos en la Reserva de la biosfera "Península de Guanahacabibes", Cuba. Acta Botánica Cubana 2006; 193: 21-26.
6. Alexiades M. N. Selected Guidelines for Ethnobotanical Research: A Fiel Manual. The New York Botanical Garden, New York 1996.
7. Martin G. Etnobotany: a methods manual. London. Chapman & Hall 1995.
8. Cunningham A B. Etnobotánica Aplicada Pueblos, Uso de plantas y Conservación. Fondo Mundial para la Naturaleza (WWF) (Ed.) Montevideo, Uruguay 2001.
9. Acevedo-Rodriguez P, Strong M T. Catalogue of Seed Plants of the West Indies. Smithsonian Institution Scholarly Press. 2012.
10. Lot A, Chiang F. Manual de herbario. Administración y manejo de colecciones técnicas de recolección y preparación de ejemplares botánicos. Talleres de Programas Educativos, S. A. de C. V. 1986.
11. Duke J A, Bogenschutz M J. Dr. Duke's. Phytochemical and Ethnobotanical Databases. Phytochemical Database, USDA Beltsville Agricultural Research Center, Beltsville, Maryland 2003. In: http://www.ars-grin.gov/duke/

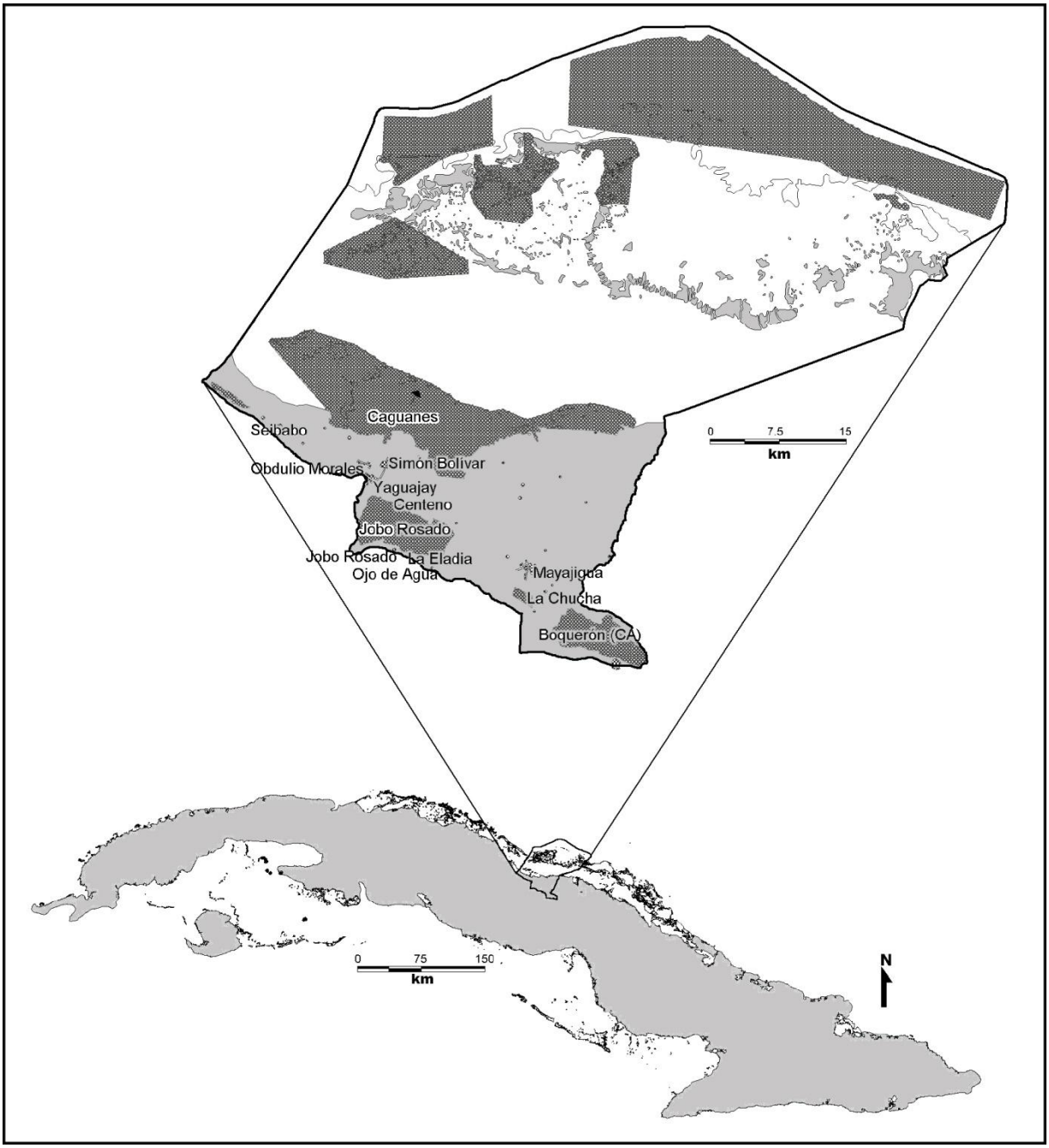
Table 1. Inventory of the medicinal plants used by the interviewees in the Biosfera Reserve Buenavista.

Family	Species	Habit
Alliaceae	*Allium cepa* L.	Grass
Anacardiaceae	*Mangifera indica* L.	Tree
Annonaceae	*Annona squamosa* L.	Tree
Apocinaceae	*Catharanthus roseus* (L.) G. Don	Grass
Apocinaceae	*Rauwolfia tetraphylla* Griseb. *	Shrub
Arecaceae	*Cocos nucifera* L.	Tree
Bignonaceae	*Crescentia cujete* L.	Tree
Bombacaceae	*Ceiba pentandra* (L.) Gaertn.	Tree
Canelaceae	*Canella winteriana* L.	Shrub
Caricacea	*Carica papaya* L.	Shrub
Commelinaceae	*Commelina elegans* H. B. K.	Shrub
Crassulaceae	*Kalanchoe brasiliensis* Camb.	Grass
Escrofulariaceae	*Capraria biflora* L.	Grass
Euphorbiaceae	*Manihot esculenta* Crantz	Shrub
Euphorbiaceae	*Ricinnus communis* L.	Grass
Geraniaceae	*Pelargonium graveolens* L`herit	Grass
Lamiaceae	*Ocimum bacilicum* L.	Grass
Liliaceae	*Aloe vera* (L.) Burm. f.	Grass
Solanaceae	*Capsicum annuun* L.	Shrub
Rutaceae	*Citrus aurantium* L.	Tree
Myrtaceae	*Eugenia floribunda* West.	Tree
Malvaceae	*Hibiscus rosa-sinensis* L.	Shrub
Oleaceae	*Jasminus grandifolium* L.	Grass
Meliaceae	*Melia azederach* L.	Tree
Rubiaceae	*Morinda citrifolia* L.	Shrub
Musaceae	*Musa x paradisiaca* L.	Shrub
Lamiaceae	*Ocimum sanctum* L.	Grass
Lauraceae	*Persea americana* Mill. *var mericana*	Tree
Phytolacaceae	*Petiveria alliacea* L.	Grass
Plantaginaceae	*Plantago major* L.	Grass
Myrtaceae	*Psidium guajava* L.	Shrub
Solanaceae	*Solanum nigrum* L.	Grass
Rubiaceae	*Spermacoce tenuior* Lam.	Grass
Malvaceae	*Hibiscus elatus* Sw.	Tree
Meliaceae	*Trichilia hirta* L.	Tree
Turneraceae	*Turnea ulmifolia* L.	Shrub

Table 2. Parts used and uses of the species with potential to obtain phytoestrogens in the Biosfera Reserve "Buenavista". (1- anticancer 2- belly diseases 3- cardiovascular affections 4- inflammations 5- abortive 6- diseases of the genital organs 7- menopause 8- regulation of the menstrual period 9- arterioesclerosis).

Species	Parts Used	Uses
Allium cepa L.	Bulbs	1
Aloe vera (L.) Burm. f.	Leaves	6, 2, 1
Annona squamosa L.	Leaves	1, 8, 4
Canella winteriana L.	Bark	6
Capraria biflora L.	Leaves	7, 2, 4
Capsicum annuun L.	Fruit and Seed	1, 3
Carica papaya L.	Fruit	6, 2, 1
Catharanthus roseus (L.) G. Don	Flower	6, 2
Ceiba pentandra (L.) Gaertn.	Shoot	5, 8
Citrus aurantium L.	Fruit	8
Cocos nucifera L.	Fruit water	9, 7
Commelina elegans H. B. K.	Leaves	4
Crescentia cujete L.	Fruit	2
Eugenia floribunda West.	Leaves	6
Hibiscus rosa-sinensis L.	Flower	5
Jasminus grandifolium L.	Leaves	3, 4
Kalanchoe brasiliensis Camb.	Leaves	4
Mangifera indica L.	Fruits and Leaves	2, 7, 3
Manihot esculenta Crantz	Root	1
Melia azederach L.	Leaves	3
Morinda citrifolia L.	Complete plant	1, 3
Musa x paradisiaca L.	Fruit	1
Ocimum bacilicum L.	Leaves	1
Ocimum sanctum L.	Leaves	1
Pelargonium graveolens L`herit	Leaves	3
Persea americana Mill. *var mericana*	Fruit	5, 8
Petiveria alliacea L.	Leaves	1
Plantago major L.	Leaves	2, 8
Psidium guajava L.	Leaves	2, 7, 1
Rauwolfia tetraphylla Griseb.	Leaves	3
Ricinnus communis L.	Seeds	5
Solanum nigrum L.	Complete plant	4
Spermacoce tenuior Lam.	Leaves	2
Hibiscus elatus Sw.	Leaves	7
Trichilia hirta L.	Leaves	5
Turnea ulmifolia L.	Leaves and flower	2

Fig. 1 Study area. Locations where the etnobotanical project was carried out in the Biosfera Reserve Buenavista.



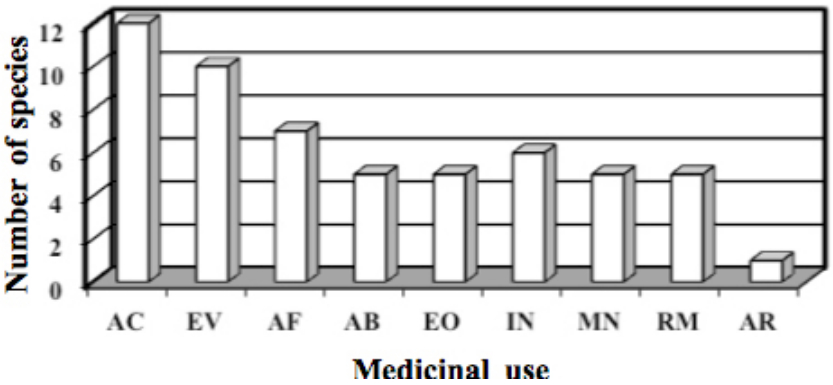


Fig. 2. Medicinal use of the species potentially useful for the obtain of phytoestrogens in the Biosfera Reserve Buenavista (AC: anticancer; BD: belly diseases; CF: cardiovascular affections; AB: abortive; GO: diseases of the genital organs; IN: inflammations; MN: menopause; RM: for the regulation of menstrual period; AR: arteriosclerosis).

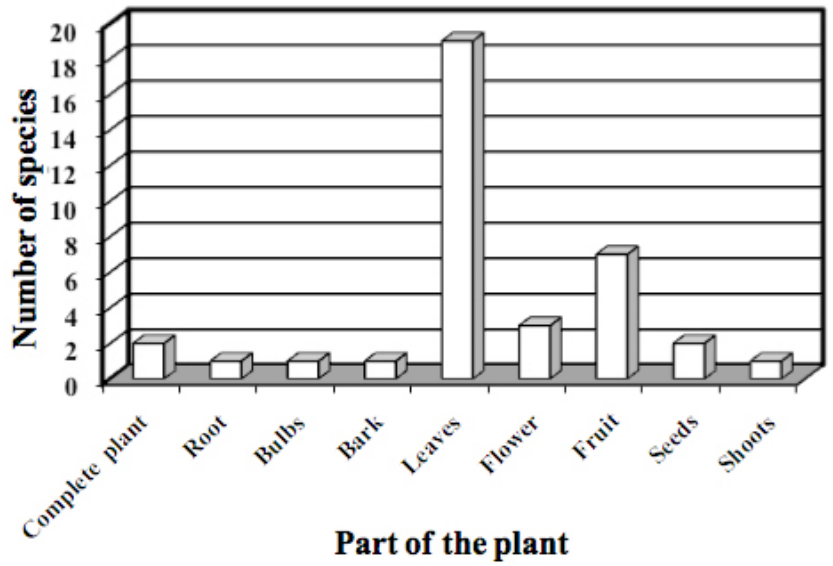


Fig. 3. Used plant parts of the species potentially useful for the obtain of phytoestrogens in the Biosfera Reserve Buenavista.

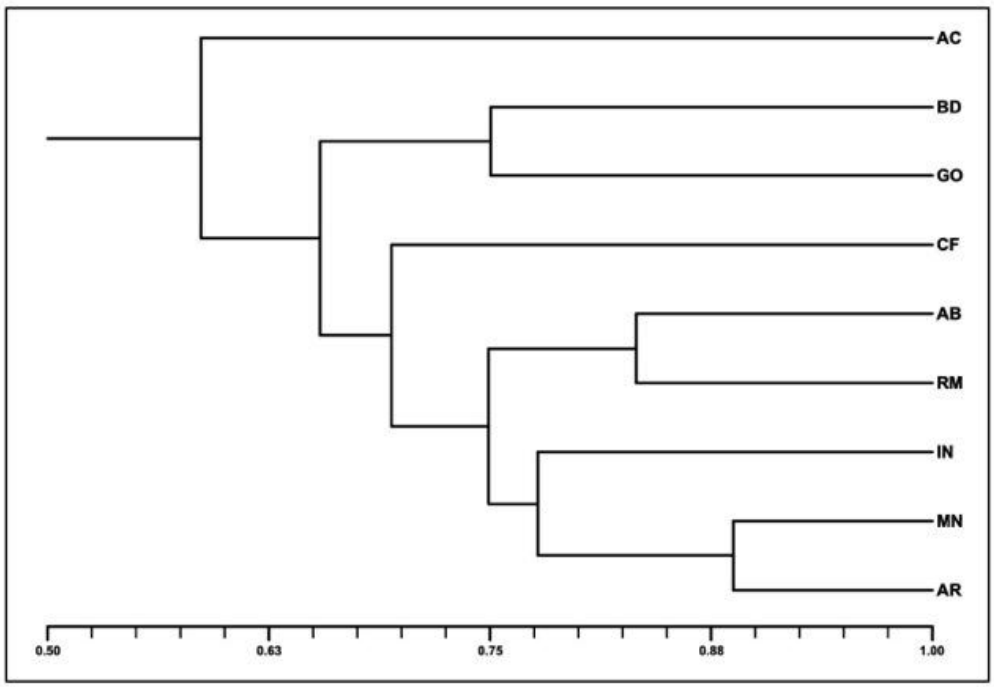


Fig. 4. Level of similarity among the uses of the species (AC: Anticancer; BD: Belly diseases; CF: cardiovascular affections; AB: abortive; GO: diseases of the genital organs; IN: Inflammation; MN: Menopause; RM: regulation of the menstrual period; AR: arteriosclerosis).

Appendix 1: Basic matrix of data: (AC: Anticancer; BD: Belly diseases; CF: Cardiovascular affections; AB: Abortive; GO: Diseases of the genital organs; IN: Inflammation; MN: Menopause; RM: Regulation of the menstrual period; AR: Arteriosclerosis).

Species	AC	BD	CF	AB	GO	IN	MN	RM	AR
Allium cepa L.	1	0	0	0	0	0	0	0	0
Aloe vera (L.) Burm. f.	1	1	0	0	1	0	0	0	0
Annona squamosa L.	1	0	0	0	0	1	0	1	0
Capsicum annuun L.	1	0	1	0	0	0	0	0	0
Carica papaya L.	1	1	0	0	1	0	0	0	0
Manihot esculenta Crantz	1	0	0	0	0	0	0	0	0
Morinda citrifolia L.	1	0	1	0	0	0	0	0	0
Musa x paradisiaca L.	1	0	0	0	0	0	0	0	0
Ocimun bacilicum L.	1	0	0	0	0	0	0	0	0
Ocimun sanctum L.	1	0	0	0	0	0	0	0	0
Petiveria alliacea L.	1	0	0	0	0	0	0	0	0
Psidium guajava L.	1	1	0	0	0	0	1	0	0
Canella winteriana L.	0	0	0	0	1	0	0	0	0
Capraria biflora L.	0	1	0	0	0	1	1	0	0
Catharanthus roseus (L.) G. Don	0	1	0	0	1	0	0	0	0
Ceiba pentandra (L.) Gaertn.	0	0	0	1	0	0	0	1	0
Citrus aurantium L.	0	0	0	0	0	0	0	1	0
Cocos nucifera L.	0	0	0	0	0	0	1	0	1
Commelina elegans H. B. K.	0	0	0	0	0	1	0	0	0
Crescentia cujete L.	0	1	0	0	0	0	0	0	0
Eugenia floribunda West.	0	0	0	0	1	0	0	0	0
Hibicus rosa-sinensis L.	0	0	0	1	0	0	0	0	0
Jasminus grandifolium L.	0	0	1	0	0	1	0	0	0
Kalanchoe brasiliensis Camb.	0	0	0	0	0	1	0	0	0
Mangifera indica L.	0	1	1	0	0	0	1	0	0
Melia azederach L.	0	0	1	0	0	0	0	0	0
Pelargonium graveolens L`herit	0	0	1	0	0	0	0	0	0
Persea americana Mill. var. *americana*	0	0	0	1	0	0	0	1	0
Plantago major L.	0	1	0	0	0	0	0	1	0
Rauwolfia salicifolia Griseb.	0	0	1	0	0	0	0	0	0
Ricinnus communis L.	0	0	0	1	0	0	0	0	0
Solanum nigrum L.	0	0	0	0	0	1	0	0	0
Spermacoce tenuior Lam.	0	1	0	0	0	0	0	0	0
Hibiscus elatus Sw.	0	0	0	0	0	0	1	0	0
Trichilia hirta L.	0	0	0	1	0	0	0	0	0
Turnea ulmifolia L.	0	1	0	0	0	0	0	0	0