UDG

UNIVERSIDAD DE GRANMA

DiveCropS:
Diversifying Cropping Systems
Traditional knowledge and Innovative approaches

DAAD
Deutscher Akademischer Austausch Dienst
Servicio Alemán de Intercambio Académico

"Biodiversity in agricultural and forestry systems of Ecuador: experiences for sustainability"
1st Workshop. 3 – 8, November, 2019 in Ecuador

UDG CEQA CENTRO DE ESTUDIOS DE QUÍMICA APLICADA

DAAD
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"PLANTS WITH MEDICINAL POTENTIAL IN THE BIODIVERSITY OF EASTERN CUBA"

Prof. Dr. Quirino Arias Cedeño
Prof. Dr. Raúl López Sánchez
Dr. C. Eugenio Torres Rodríguez
MSc. José A. Morales León
MSc. Lázaro E. Valdés Izaguirre
Dr. MVZ. Pedro L. Guevara Blanco

Granma University

"PLANTS WITH MEDICINAL POTENTIAL IN THE BIODIVERSITY OF EASTERN CUBA"

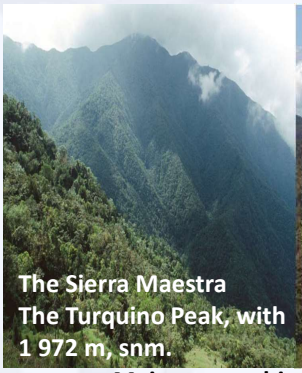
Topics:

- **Biodiversity of the Cuban East: Medicinal plants.**

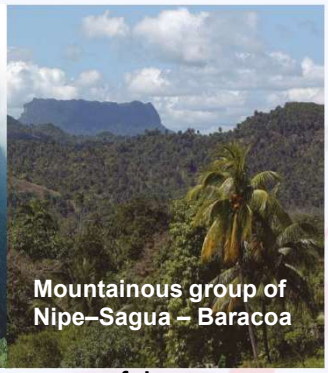
- ✓ **Study of medicinal plants in the CEQA:**
- ➔ **"In vitro" evaluation of antimicrobial, insecticidal, anti-inflammatory and antioxidant activities.**
- ➔ **Metabolic Composition Studies.**

▪ Biodiversity of the Cuban East

In the Cuban east there are the most high values of biological diversity.



The Sierra Maestra
The Turquino Peak, with 1 972 m, snm.



Mountainous group of Nipe–Sagua – Baracoa

Main orographic systems of the country

Most desert region (400 mm/year)

The rainiest area (more than 4.000 mm/year

Toa, the river with more flow.

Cauto, the longest river in Cuba and all the Antilles, 370 km.

▪ Biodiversity of the Cuban East

In the Cuban east there are the most high values of biological diversity.

The wetland of Birama, in the Cauto River Delta with 66 370.00 ha.
SITIO RAMSAR

The Marine Terraces of Cabo Cruz in the Desembarco del Granma National Park (WORLD HERITAGE SITE, 1999).

The Alejandro de Humboldt National Park, (PNAH) was declared a World Natural Heritage Site by (UNESCO, 2001).

Flora of the eastern region of Cuba

Cuba has the greatest wealth of plants in the insular Caribbean

The PNAH has a great floristic diversity, estimated in more than 1,500 species with an identified plant endemism in some areas of up to 80%. Some are true jewels of botany like *Pinguicula lignicola.*

In the list of Botanical Gardens of Cuba, the eastern region has those of Las Túnas, Holguín, Los Ferns in Santiago and the Copaynicu in Granma.

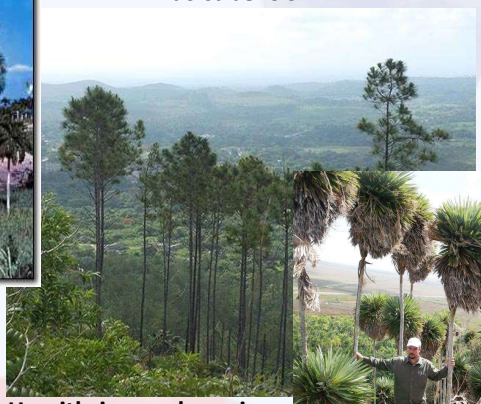
Of the Cuban Flora

Cuba has the greatest wealth of plants in the insular Caribbean

- Among the four islands with the highest number of plant species in the world.
- The first in number of taxones/ km².
- Some 11,000 species are reported, more than 50% are endemic or typical of our land.
- Cuba occupies the first place in the Antilles because of the endemism of higher plants.
- Knowledge of the conservation status of Cuban plants is acceptable with 66% of the flora currently evaluated.

Palma real

Pinus cubensis



Hemithrianax ekmaniana
(Palmita de Jumagua)

Medicinal plants of the Cuban flora

The use of medicinal plants is common in the population of Cuba

Traditional Medicine begins in the 15th century, but it is not until the middle of the 20th century that it reaches its maximum expression with the distinguished Doctor Juan Tomás Roig.

Inventories published of the medicinal plants in Cuba includes, for example:
Abreu and Mateo (1997),
Acosta de la Luz (2001),
Hernández and Volpato, Rosete et al. (2004)

Juan Tomás Roig, who identifies 595 species of medicinal plants used by the Cuban population for different healing uses.

Medicinal plants of the Cuban flora

The use of medicinal plants is common in the population of Cuba

Ethnobotanical studies

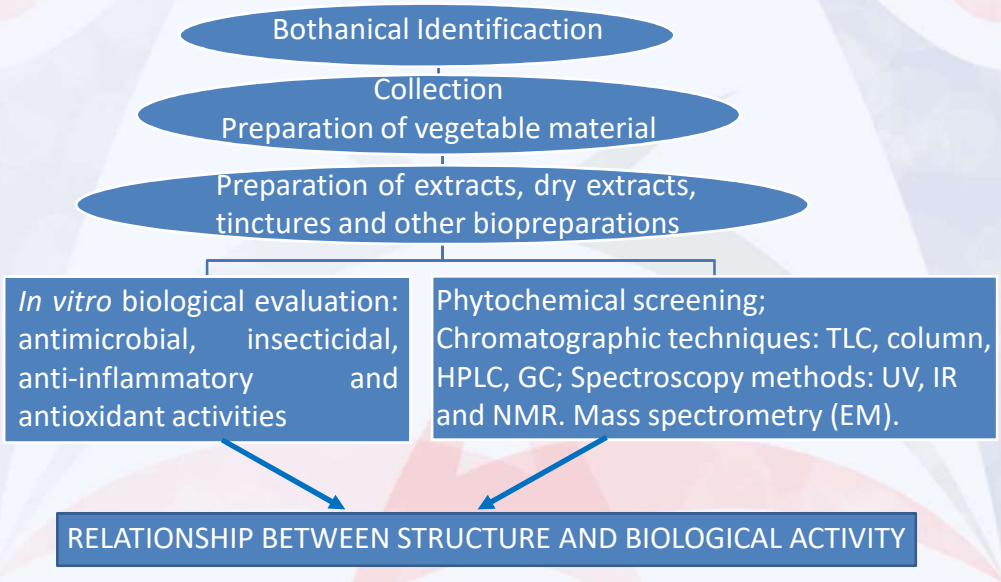
An ethnobotanical survey of medicinal plants used by inhabitants of Holguín, Eastern Region, Cuba. **Boletín Latinoamericano y del Caribe de Plantas medicinales y Aromáticas**. Volumen 17, Número 2, Marzo de 2018

Pharmaceutical preparations in the 19th and 20th centuries in the Eastern region of Cuba. **Revista Cubana de Farmacia**. 2016;50(1)

Traditional use of medicinal plants for the major adult in the mountain community Corralillo Arriba. Guisa, Granma. **Revista Cubana de Plantas Medicinales** 2015;20(4)429-439

Estudio etnobotánico sobre tres especies arvenses en localidades de la región oriental de Cuba. ***Revista Granma Ciencia***. *Vol. 15, no. 3 septiembre - diciembre 2011 ISSN 1027-975X*

General methodology

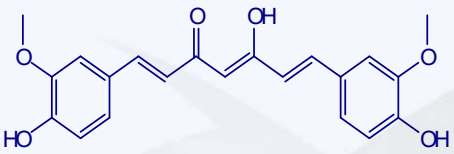


Metabolic composition and antimicrobial activity studies

Morales León JA, Torres Rodríguez E, Peña Fuentes D, Fonseca García A, Saborit Armas M, Hermosilla Espinosa R. Composición fitoquímica y actividad antibacteriana de extractos clorofórmicos de las hojas de *Cassia uniflora* Mill. **Rev Cub Plant Med**. 23(1), 2018
Eugenio Torres Rodríguez, Mayren de la Cruz Frías, Mijaíl Bullaín Galardis, José Angel Morales León. In vitro antibacterial activity of dried extract from *Anredera vesicaria* rhizomes. **Adv Plants Agric Res**. 2018;8(3):237–239.
José Angel Morales-León, Quirino Arias-Cedeño, Eugenio Torres-Rodríguez, Alejandro Alarcón-Zayas, Orlando R. Sariego-Tamayo. Actividad antibacteriana de fracciones obtenidas de las hojas de *Cassia uniflora* frente a *Staphylococcus aureus* resistente a la meticilina. **Rev. Cubana Quím**. Vol. 29, no.3, 2017, 444-455.
Yudit Acosta Campusano, Orelvis Maximiliano Castellano Lugo, José Antonio Roble Santisteban, Manuel Gondres Barreiro, Javier Angel Frías Tamayo, Eugenio Torres Rodríguez. Actividad antimicrobiana in vitro de *Pteris vittata* L. **Revista Cubana de Farmacia**. 2015; 49(4):734-741.
de la Cruz Frías M, Torres Rodríguez E, Morales León JA, Hermosilla Espinosa R, Hernández González R. Identificación de metabolitos secundarios de *Anredera vesicaria* (Yuca hiedra). **Rev Cub Plant Med**. 2016; 21(2):215-222.
Mijail Mijares Bullaín Galardis, Eugenio Torres Rodríguez, Robinson Hermosilla Espinosa. Tamizaje fitoquímico de los extractos de *Faramea occidentalis* (L.) A. Rich. (nabaco). **Revista Cubana de Plantas Medicinales**. 2014; 19(1):421-432.
Eugenio Torres R., Rogelio Moreno S., Yosvel Tamayo V., Robinson Hermosilla E., Zonia Guillén G. Estudio de la actividad antibacteriana del aceite esencial de los rizomas de *Curcuma longa* L. **Química Viva**. 2014; 2: 123-129.

Study of rhizomes of *Curcuma longa* L.

Curcumin Extraction



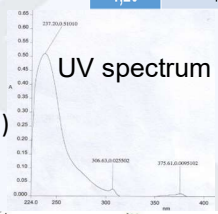
solid orange, (yield, 26 %), Tf: 182-183 °C, Rf= 0,32 (petroleum ether-ethyl acetate 2:1)

1H-NMR (DMSO-d6, 300 MHz) δ:9,95 (s, 2H, OH x 2); 10,50 (s, 1H, OH)

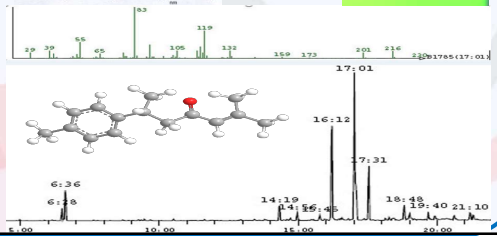
Use of ultrasound in the extraction of curcumin from its natural source. ***Revista Cubana de Plantas Medicinales***. 2014; 19 (1): 1-7.

Essential oil extraction

Rdto (% v/m)	Índice de refracción ($n^{20}D$, 20ºC)	Rotación óptica (C:1,24ºC,$CHCl_3$)
1,20	1,4969	- 33.412



UV spectrum



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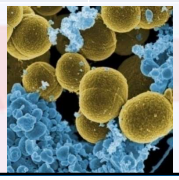
Study of rhizomes of *Curcuma longa* L.

Table: Antibacterial activity of the essential oil and curcumin extracted from rhizomes of *Curcuma longa* L.

Sample (µg/mL)	*Escherichia coli*		*Pseudomonas aeruginosa*		*Staphylococus aureus*		*Bacillus subtilis*	
	MIC	MBC	MIC	MBC	MIC	MBC	MIC	MBC
Curcumin	>128	>128	128	>128	64	>128	64	>128
Essential Oil	128	128	32	64	8	32	4	8
Penicillin	122	128	7	16	4	11	4	1



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Study of rhizomes of *Curcuma longa* L.

Table: Larvicidal and adulticidal activity of the essential oil extracted from the rhizomes of C. longa L. against the *Aedes aegypti* mosquito.

Essential oil	Population	Larvicidal activity		Adulticidal activity (Dose: 50 mg/mL)	
		CL_{50} (%)	CL_{90} (%)	TKN_{50}(h)	TKN_{90}(h)
Curcuma longa L.	Rockefeller	0.0083	0.0121	0.35	0.55
	Marianao 2013	0.008	0.014	0.39	0.68



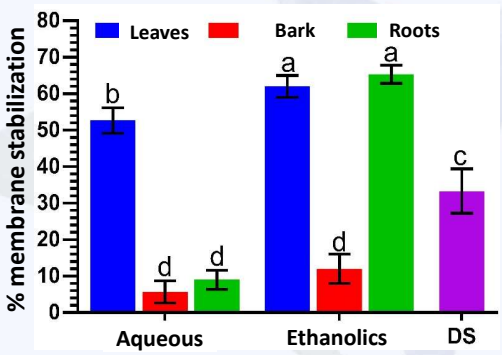

Study of *Jatropha aethiopica* Müell Arg.

Phytochemical composition of the extracts

Metabolites \ Extracts	Ethanolic Extract			Aqueous Extract		
	Roots	Bark	Leaves	Roots	Bark	Leaves
Coumarins	+	++	++			
Cardiotonic glycosides	+	-	+			
Saponins	++	-	+	-	-	-
Triterpenes	+	+	-			
Steroids	-	-	+			
Alkaloids	+	-	++	++	+	++
Flavonoids	+	+	+	+	+	+
Anthocyanidins	+	+	-			
Quinones	-	+	+			
Catechins	+	+	+			
Phenols	+	+	+	+	+	+
Tanins	-	-	+	-	-	-

(+) Present; (++) Abundant; (-) Absent, ( ) Unexplored.

Anti-inflammatory activity



DS: diclofenac sodium (positive control)

Valdés-Izaguirrel LE, Arias Cedeño Q, Peña Fuentes D. Actividad antiinflamatoria y antioxidante *in vitro* de extractos etanólicos de *Jatropha aethiopica* Müell Arg var *inermis*. **Rev Cub Quím** 2018, 30(3):440-453

Study of antioxidant activity of *J. aethiopica* and *Luffa cylindrica*.

Ferric reducing potential of the extracts in µmol/mL Fe^{2+} (Mean ± SD)

Concentration (mg/mL)	*J. aethiopica* leaves	*L. cylindrica* fruits
5	36.30 ± 2.54 [a, 1]	25.47 ± 2.04 [a, 2]
10	37.86 ± 2.65 [a, 1]	30.60 ± 2.45 [a, 2]
50	47.38 ± 3.32 [b, 1]	37.64 ± 3.01 [b, 2]

Quirino Arias Cedeño, Lázaro Eduardo Valdés Izaguirre, Nolberto Remón Zamora, Jorge Ramírez Arzuaga. Capacidad antioxidante *in vitro* de extractos etanólicos del fruto de *Luffa cylindrica* L. Roem. **Multimed** 2018; 22 (4). (DOAJ) http://www.revmultimed.sld.cu/index.php/mtm/article/view/921

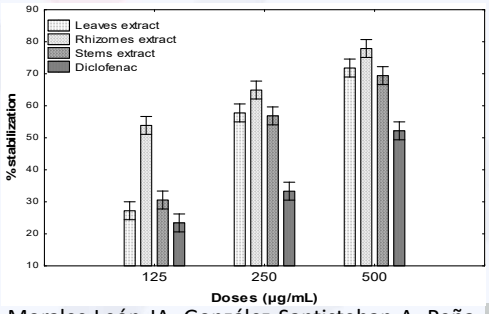
Total antioxidant capacity of extracts
in mg/mL equivalent of ascorbic acid (Mean ± SD)

Concentration (mg/mL)	*J. aethiopica* leaves	*L. cylindrica* fruits
5	0.36 ± 2.2E-02 [a, 1]	0.097 ± 4E-03 [a, 2]
10	0.50 ± 3.3E-02 [b, 1]	0.257 ± 1.2E-02 [b, 2]
50	1.53 ± 0,1 [c, 1]	0.891 ± 4E-02 [c, 2]

Total phenolic content of extracts
in mg equivalent of gallic acid per gram of dry extract (Mean ± SD)

J. aethiopica leaves	*L. cylindrica* fruits
74.17 ± 0.02 [1]	32,54 ± 3,09 [2]

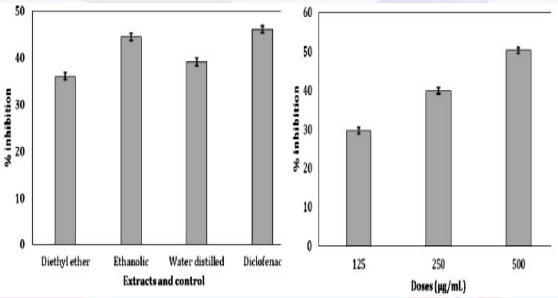
Study of *Anredera vesicaria*.



Saponins, phenols, flavonoids, coumarins, alkaloids and triterpenes.

Morales León JA. In Vitro Anti-Arthritic Activity of Extracts in Water, Ethanol and Diethyl Ether of Rhizomes from Anredera Vesicaria. **ARC J Pharm Sci**,2018;4(4):7-12. DOI: http://dx.doi.org/10.20431/2455-1538.0404002

Morales León JA, González Santisteban A, Peña Fuentes D, Guardia Puebla Y, Torres Rodríguez E. In vitro anti-inflammatory activity of aqueous, ethanolic and ethereal extracts of rhizomes, leaves and stems of Anredera vesicaria. **J Anal Pharm Res**. 2018;7(4):459-461. DOI: 10.15406/japlr.2018.07.00266



Farms of medicinal plants in Eastern Cuba.

El Edén

At present, more than 100 varieties of these herbs are used in traditional cuban medicine.

El Sol de Oriente

La Demajagua

Cuba has 600 hectares distributed in 142 farms, in which 42 species of medicinal plants are cultivated, producing more than 300 tons/year.

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Flora de la región oriental de Cuba

- A detailed **vegetation's classification of the Eastern Region of Cuba**, the main elements are the Cloud forests, Rainforests, Evergreen forests, Semideciduous forests, Pine forests, Scrub vegetation, Vegetation complexes, Grasslands, Aquatic vegetation, Cultural vegetation and Secondary vegetation.

Reyes, O. (BIOECO) .
Revista del Jardín Botánico Nacional
Vol. 32/33 (2011-2012), pp. 59-71