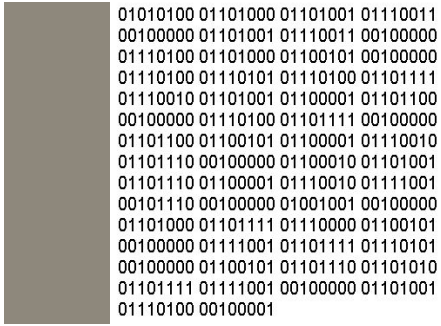

ISCB-LA SoIBio BioNetMX Symposium ‹2020›

Analysis of the Bibliometric Impact of Novel Biomolecules Discovered in Panama through Bioprospecting

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Introduction, Objectives & Methodology

Introduction-Motivation

- Over the last 20 years, in The Republic of Panama, important molecular data has been generated through the **identification and isolation of new biomolecules from natural resources.**
- These biomolecules have been assessed for its potential for **health and biotechnology.**
- This work has been achieved mainly through research organized by the ***International Cooperative Biodiversity Group*** **(ICBG)** [1] with local researchers.

The Nagoya Protocol basically states that "*the local population should* ***also*** *benefit from the use of their genetic resources*"[2]. Since 2012, the Republic of Panama is a signatory of this protocol.

Bioeconomy

According to Aguilar *et al.* [3] "bioeconomy is a new paradigm whose aim is to create, develop, and revitalize economic systems based on a sustainable use of renewable biological resources". For its development, advances in science, technology, and biotechnology are important [4].

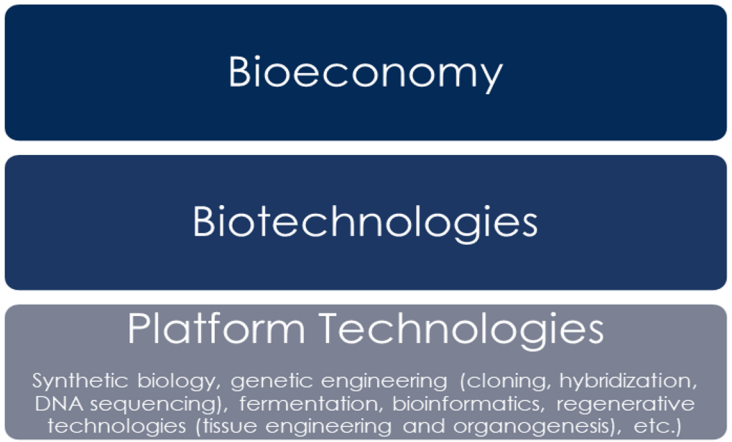

Figure 5. Platform technologies, biotechnologies, and bioeconomy: Hierarchy of ties. Adapted from [3]

Objectives

Part of the motivation of this work, follows the **spirit** of the Nagoya Protocol, is to ***assess what are these biomolecules***, by looking as how they are ***reported in the scientific literature***.

- In addition, ***how much is known about these molecules*** and **how they been used** and more importantly if this information is **publicly accessible**.
- How many **Panamanian** researchers have **benefitted from these publications in terms of authorships**?
- Special attention has been place on **how these molecules** has been or could be introduced into a biobased economy or **bioeconomy framework** and take advantage of its discovery.
- A **repository** of the results is present and open to the public

Methodology

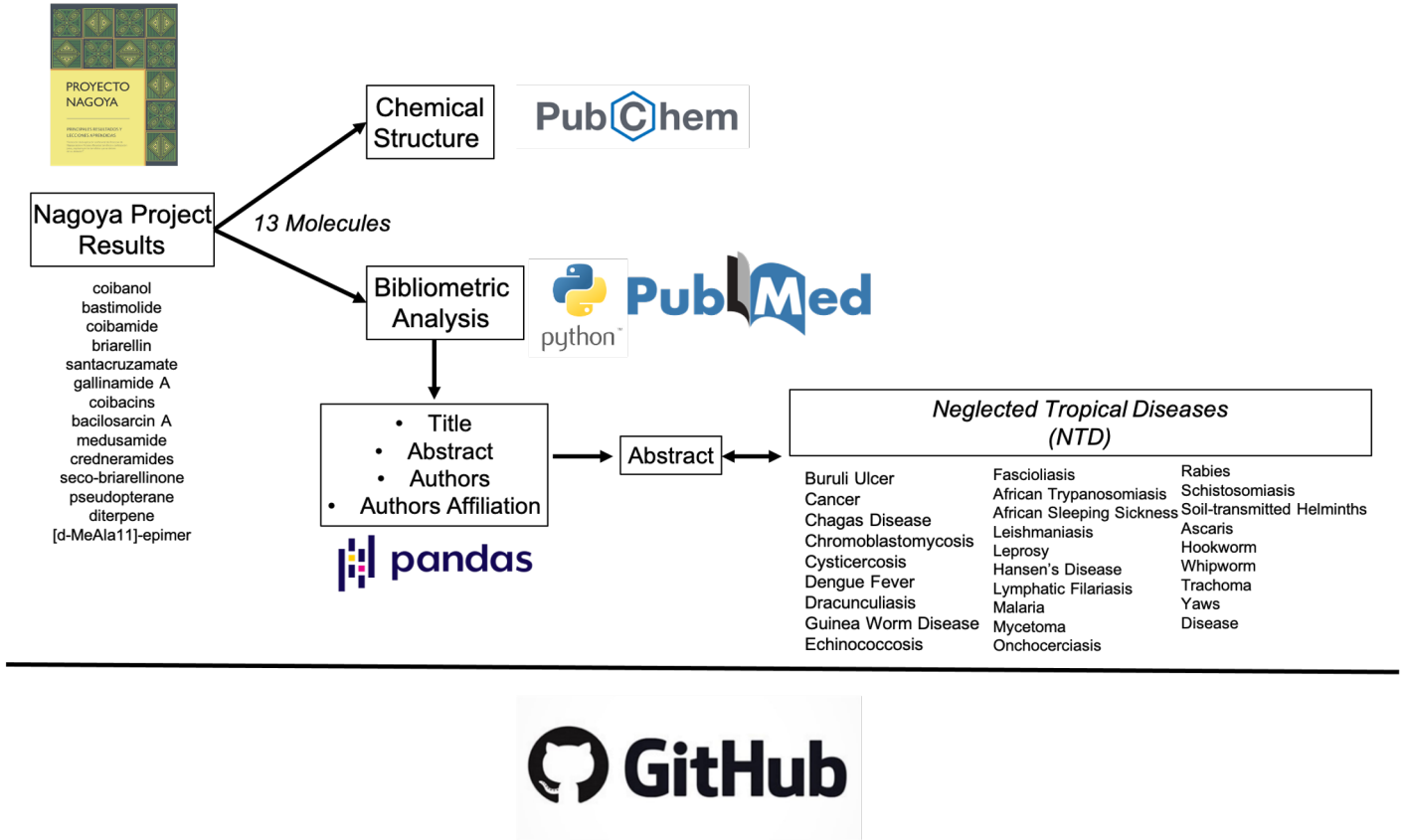

Figure 1 – Methodology and Visual Abstract

Results

Results - Chemical Structures

#	Molecule Name	Search Pattern	PubChem Unique Identifier as Compounds (PubChemID)	Website (Information and Structure)	2-D Structure	3-D Structure
1	Coibanol A/B/C	Coibanol	139588374	https://pubchem.ncbi.nlm.nih.gov/compound/139588374		
2	Bastimolide A	Bastimolide	318733489	https://pubchem.ncbi.nlm.nih.gov/substance/318733489		-
3	Coibamide A	Coibamide	274680465	https://pubchem.ncbi.nlm.nih.gov/substance/274680465		-
4	Briarellin A / B	Briarellin	9983138	https://pubchem.ncbi.nlm.nih.gov/compound/9983138		
5	Seco-Briarelline (Cecobrialemilona)	Seco-Briarelline	15275618	https://pubchem.ncbi.nlm.nih.gov/compound/15275618		
6	Pseudopterane Diterpene (Aeucerapterano de Interpeno)	Pseudopterane Diterpene	-	-	-	-
7	Santacruzamate A	Santacruzamate	72946782	https://pubchem.ncbi.nlm.nih.gov/compound/72946782		
8	Gallinamide A	Gallinamide	25209862	https://pubchem.ncbi.nlm.nih.gov/compound/25209862		-
9	Coibacins A/B/D	Coibacins	-	-	-	-
10	Mamaelomide	[d-MeAla11]-Epimer	-	-	-	-
11	Cremenamide A/B	Credneramides	-	-	-	-
12	Bacilosarcin A	Bacilosarcin	273801231	https://pubchem.ncbi.nlm.nih.gov/substance/273801231		-
13	Medusamide A	Medusamide	355358042	https://pubchem.ncbi.nlm.nih.gov/substance/355358042		-

In ***Table 1,*** the molecules are listed, their structure is also shown (confirmed by computational model or crystallography) and it is determined whether or not there is digital access to their structure in PubChem.

Results - Bibliometric Analysis (1/2)

In the analysis, the number of articles found in PMC was reported for each of the molecules ***Table 2.*** In addition, the contribution of the most prolific national and foreign authors was analyzed, which are reported in ***Table 3***.

Molecule Name	Number of Articles
Coibanol	2
Bastimolide	13
Coibamide	20
Briarellin	17
Seco-Briarelline	5
Pseudopterane Diterpene	19
Santacruzamate	20
Gallinamide	20
Coibacins	13
[d-MeAla11]-Epimer	2
Credneramides	7
Bacilosarcin	10
Medusamide	3
Total	152

Table 2. Bibliometric information associated to the molecules found in the PubMed database

Most Prolific Authors	Number of Articles
Gerwick WH	23
McPhail KL	14
Gutierrez M /	10
Rodriguez AD / Taglialatela-Scafati O /	9
Ishmael JE	8
Mayer AMS, **González Y**	7

Table 3. Authors with more publications (Top-6)

Results - Bibliometric Analysis (2/2)

When looking at the authorships of the **152** articles found, Over 120 articles had 1 or no, Panamanian ***Figure 3 .*** When looking at those articles with Panamanian Authors, in **Figure 4**, it shows that they tend to work in groups. **Table 4**, show the results for mentions of authorship and co-authorship in published articles by Institutions.

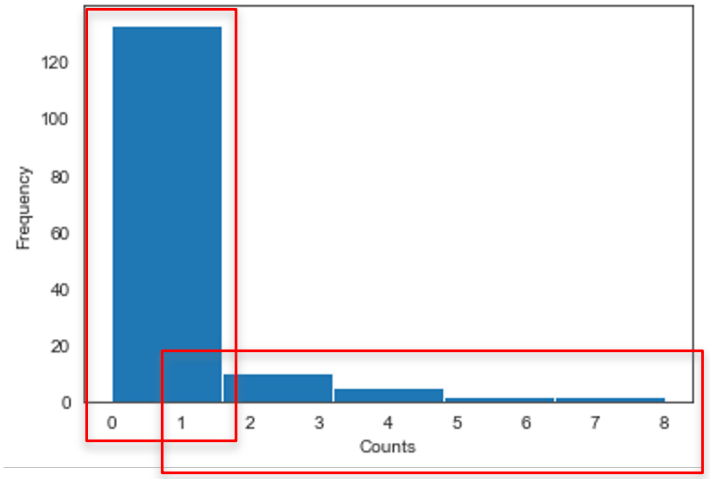

Figure 3 – Histogram of the distribution of Panamanian author in the articles.

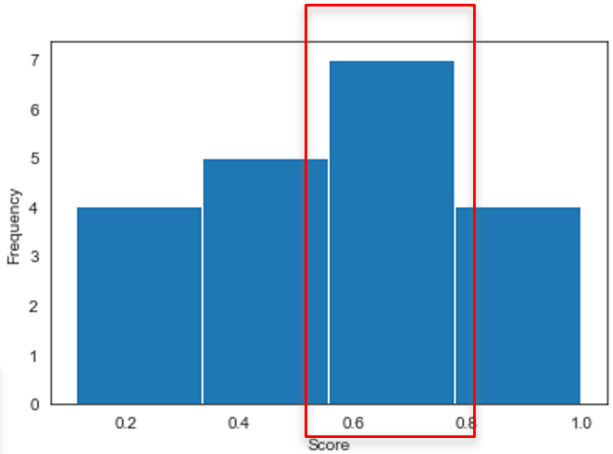

Figure 4 – Histogram of the ratio of Panamanian authors on articles having at least one Panamanian author.

Institution Name	Number of Authorships
INDICASAT	58
Smithsonian Tropical Research Institute	7
Universidad de Panamá	4
Universidad Tecnológica de Panamá	0

Table 4. Authorships by Local Institutions

Results - Bibliometric Analysis - Diseases

In ***Figure 2***, shows a Sankey Plot of the molecules and the diseases that they have been related to in the literature found.

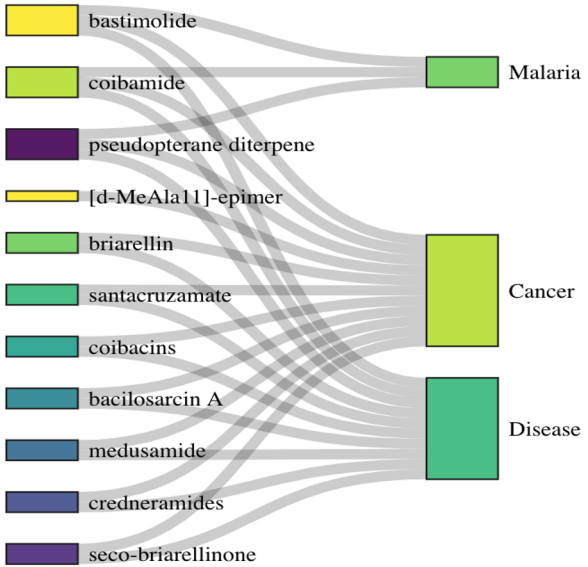

Figure 2 – Sankey Plot of the molecules and the NTD and other maladies that they are realted

Github repository

Information, code and results can be found in this Github repository:

https://github.com/jsgalan/MoleculesPanama

Bioeconomy in Panama - Some Ideas

Origin	Application			
	Biomedicine	**Industrial Biotechnology**	**Food Biotechnology**	**Agricultural Biotechnology**
Biopharmaceutics	Drugs discovery for biomedicine and pharmaceutical industry		Functional foods and nutritionals	Biological pest management?
Food Biotechnology	Fruit, vegetable, herbal plants for bio-drug?	Fruit, vegetables for cosmetics?	Functional nutritive ingredients tailor-made products, food proteins.	Protein- and vitamin-rich complexes
Agricultural Biotechnology	Vaccines, antibiotics (genetically engineered crops to carry antigenic proteins from infectious pathogens, that will trigger an immune response when ingested)?	Protein isolates and textured proteins, food fiber.		Enhancing plants and animal traits?
Science	Mapping of organisms' genomes, biobanks, bioinformatics, systemic medicine, production of nano-based bactericides and virucides (potentially)	Brain studies for application in Industry; analytical instrumentation	Enzyme engineering, food flavorings, coloring and preservation?	Pathogen-Host studies?

Input-output matrix "origin-application". Adapted from [5]

Conclusions

The analysis of the scientific production associated with these molecules can help organize a **massive database of Panamanian molecules**. It can also be a reference for various species **biobank projects** that can be developed in our country.

The analysis shows that most of the authors are **foreigners**, although a good complement of national scientists from INDICASAT-AIP and the University of Panama. There several **authors and groups** working together.

This work clarifies what the molecules of this project are for, about their possible use in the sector to treat diseases such as **cancer and malaria**.

Future Work

- Long-term study (search periodically)
- Add other molecules that have been studied
- Look at those molecules with 3-D Structure for computational studies (docking?)
- Keep thinking how these molecules can be used in a bioeconomy framework

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