



HAL
open science

Extraction of association implication rules from knowledge on plants with pesticidal and antibiotic effect classified by FCA within the One-Health initiative

Lina Mahrach, Alain Gutierrez, Marianne Huchard, Priscilla Keip, Pierre Silvie, Pierre Martin

► To cite this version:

Lina Mahrach, Alain Gutierrez, Marianne Huchard, Priscilla Keip, Pierre Silvie, et al.. Extraction of association implication rules from knowledge on plants with pesticidal and antibiotic effect classified by FCA within the One-Health initiative. JOBIM 2020 - 20es Journées Ouvertes de Biologie, Informatique et Mathématiques, Jun 2020, Montpellier, France. , 2020. hal-03085734

HAL Id: hal-03085734

<https://hal.science/hal-03085734>

Submitted on 11 Feb 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Extraction of association rules from knowledge on plants with pesticidal and antibiotic effect classified by FCA for the One-Health initiative

© Cirad - C. Poser

MAHRACH L.¹, GUTIERREZ A.², HUCHARD M.², KEIP P.¹, SILVIE P.^{1,3}, MARTIN P.¹
¹ Cirad, UPR AïDA, Avenue Agropolis, F-34398 Montpellier, France
² AïDA, Univ Montpellier, Cirad, Montpellier, France
³ LIRMM, Université de Montpellier, CNRS, Montpellier, France
³ IRD, UMR IPME, F-34394 Montpellier, France
e-mail: lina.mahrach@etu.umontpellier.fr

Introduction

Reducing the use of pesticides and antibiotics is a major challenge to manage resistance and to provide sustainable production systems. To this end, the Knomana knowledge base is being developed. Knomana gathers descriptions of plant extract uses with pesticidal, antimicrobial, and antiparasitic effect for plant, animal, and human health.

Aim

Identifying local plants to solve a phytosanitary situation that meet One-Health initiative, e.g. not already used for human health to prevent any undesirable induced effect such as the development of resistance that makes these plants anymore usable.

Example: Identifying local plants to control *Spodoptera littoralis* on tomato crop in Burkina Faso

Method

Exploration algorithm

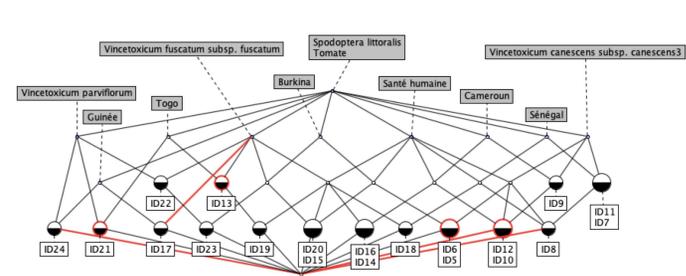
1. Building the dataset

Nom latin plante	Nom vernaculaire (français, anglais)	Langue du nom vernaculaire	Famille botanique	Pays où la plante est protégée (Français, Anglais)	Organisme à protéger (espèce de plante)	Nom latin
Vincetoxicum canescens subsp. canescens	Burkina	tomate	Spodoptere littoralis			
Vincetoxicum canescens subsp. canescens	Apogonase	Burkina	tomate	Spodoptere littoralis		
Vincetoxicum canescens subsp. canescens	Apogonase	Sénégal	tomate	Spodoptere littoralis		
Vincetoxicum canescens subsp. canescens	Apogonase	Cameroon	tomate	Spodoptere littoralis		
Vincetoxicum canescens subsp. canescens	Apogonase	Cameroon	tomate	Spodoptere littoralis		
Vincetoxicum canescens subsp. canescens	Apogonase	Togo	tomate	Spodoptere littoralis		
Vincetoxicum canescens subsp. canescens	Apogonase	Cameroon	tomate	Spodoptere littoralis		
Vincetoxicum canescens subsp. canescens	Apogonase	Cameroon	tomate	Spodoptere littoralis		
Vincetoxicum canescens subsp. canescens	Apogonase	Cameroon	tomate	Spodoptere littoralis		
Vincetoxicum canescens subsp. canescens	Apogonase	Burkina	tomate	Spodoptere littoralis		

Nom latin plante	Nom vernaculaire (français, anglais)	Langue du nom vernaculaire	Type de santé	Utilisé en médecine traditionnelle	Proche d'une plante médicamenteuse
Vincetoxicum canescens subsp. canescens	Santé humaine		Santé humaine	oui	non
Vincetoxicum canescens subsp. canescens	Santé humaine		Santé humaine	oui	non
Vincetoxicum canescens subsp. canescens	Santé humaine		Santé humaine	oui	non
Vincetoxicum canescens subsp. canescens	Santé humaine		Santé humaine	oui	non
Vincetoxicum canescens subsp. canescens	Santé humaine		Santé humaine	oui	non
Vincetoxicum canescens subsp. canescens	Santé humaine		Santé humaine	oui	non
Vincetoxicum canescens subsp. canescens	Santé humaine		Santé humaine	oui	non
Vincetoxicum canescens subsp. canescens	Santé humaine		Santé humaine	oui	non
Vincetoxicum canescens subsp. canescens	Santé humaine		Santé humaine	oui	non
Vincetoxicum canescens subsp. canescens	Santé humaine		Santé humaine	oui	non

Dataset 1: Plants used to solve the phytosanitary problem
 Dataset 2: Additional information on the plants

2. Representing the dataset as an FCA lattice*



* Performed using conexp, available at <http://conexp.sourceforge.net/>

3. Extracting the rules*

- 1 < 20 > { } ==> Tomate S.littoralis;
- 2 < 2 > Tomate S.littoralis V.canescens subsp. canescens3 Burkina ==> Santé humaine;
- 3 < 1 > Tomate S.littoralis Sénégal V.fuscatum subsp. fuscatum ==> Santé humaine;
- 4 < 2 > Tomate S.littoralis Cameroun V.fuscatum subsp. fuscatum ==> Santé humaine;
- 5 < 1 > Tomate S.littoralis Santé humaine Togo ==> V.fuscatum subsp. fuscatum;
- 6 < 1 > Tomate S.littoralis Burkina V.parviflorum ==> V.fuscatum subsp. fuscatum;

=> V. parviflorum not used for human health

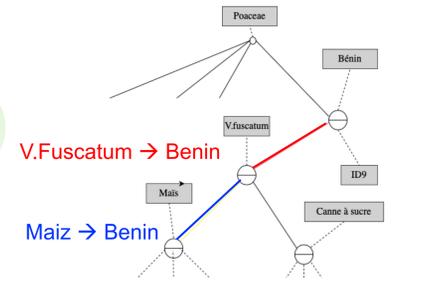


Fig 2. Example of rules on an FCA lattice

Implementation

Step 1 : Identification of protecting plants already used for human health according to the existing pieces of knowledge of Knomana

- Dataset 1 : Description of plant used to control *S. littoralis* according to Knomana (e.g. protected crop, country)
 - Dataset 2 : Indication on the use of each of these plants for human and public health (e.g. treated disease and considered countries)
- Results: plants used and not used for human and public health

Step 2 : Identification of plants that are similar to the ones used for crop protection

- Dataset 1 : Plants not used for human and public health identified at step 1
 - Dataset 2 : Additional plant descriptors (e.g. genus, chemical composition provided by Knomana or other databases, presence in the country)
- Results : local plants to control *S. littoralis* with the shared and unshared similarities

Conclusion

This method enables the identification of plants to control pest that are already used for human and public health. These plants have to be tested in-field before their adoption by farmers and technicians. The addition of types of information (e.g. the family of the plant) or their removal (remove the species but keeping the genus) modifies the classification and then conducts to identify new rules. This exploration method can also enable to identify plants according to their chemical components.

References

E. Paul J. Gibbs. The evolution of One Health: a decade of progress and challenges for the future. Veterinary Record, 174(4): 85-91, 2014.
 Pierre Martin, Samira Sarter, and Pierre Silvie. KNOMANA – Usage des plantes à effet pesticide, antimicrobien, antiparasitaire et antibiotique. Version 1. IDDN.FR.001.130024.000.S.P.2019.000.31235, 2019.
 Bernhard Ganter and Rudolf Wille. 1999. Formal concept analysis - mathematical foundations. Springer
 Karel Bertet, Christophe Demko, Jean-François Viaud, and Clément Guérin. Lattices, closures systems and implication bases: A survey of structural aspects and algorithms. Theor. Comput. Sci. 743: 93-109, 2018.

Acknowledgements

This work was supported by the French National Research Agency under the investments for the Future Program, referred as ANR-16-CONV-0004.

