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

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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

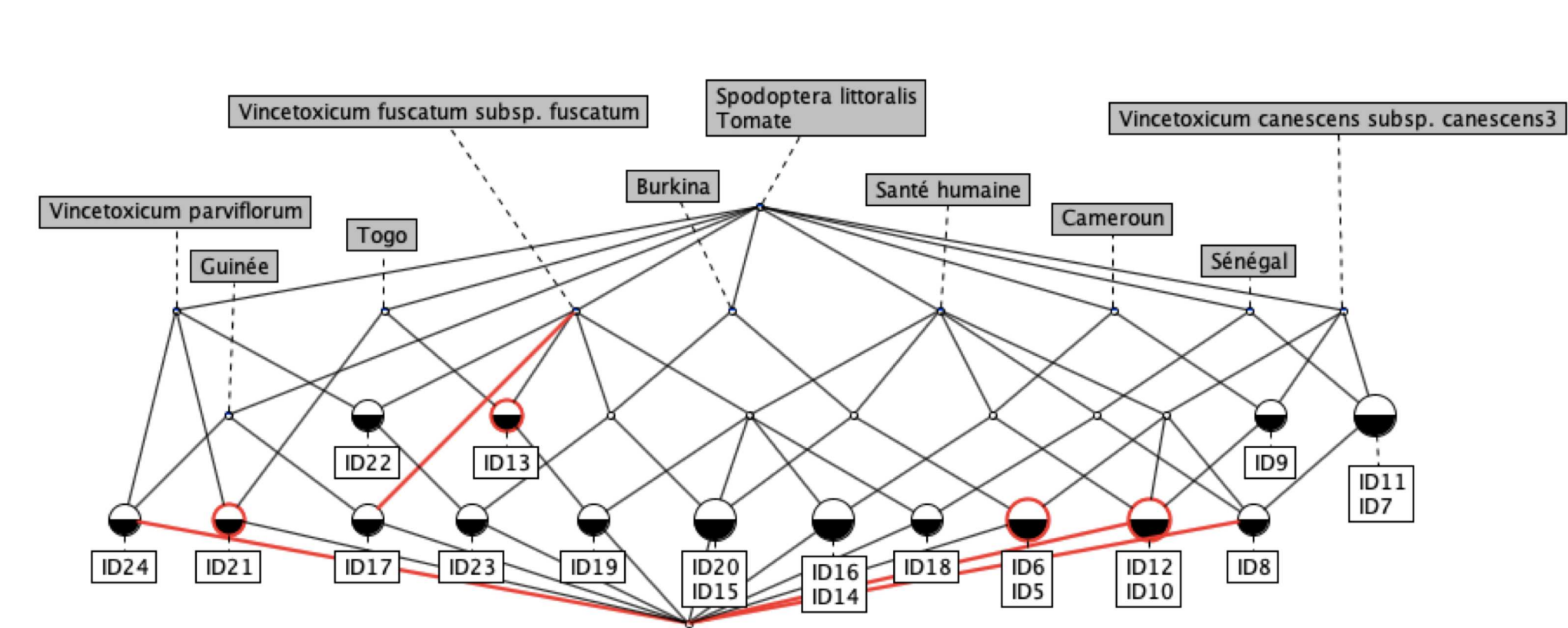
1. Building the dataset

| 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 | Spodoptera littoralis | | | |
| Vincetoxicum canescens subsp. canescens | Apogonase | Burkina | tomate | Spodoptera littoralis | | |
| Vincetoxicum canescens subsp. canescens | Apogonase | Sénégal | tomate | Spodoptera littoralis | | |
| Vincetoxicum canescens subsp. canescens | Apogonase | Cameroon | tomate | Spodoptera littoralis | | |
| Vincetoxicum canescens subsp. canescens | Apogonase | Cameroon | tomate | Spodoptera littoralis | | |
| Vincetoxicum canescens subsp. canescens | Apogonase | Togo | tomate | Spodoptera littoralis | | |
| Vincetoxicum canescens subsp. canescens | Apogonase | Cameroon | tomate | Spodoptera littoralis | | |
| Vincetoxicum canescens subsp. canescens | Apogonase | Cameroon | tomate | Spodoptera littoralis | | |
| Vincetoxicum canescens subsp. canescens | Apogonase | Burkina | tomate | Spodoptera 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**

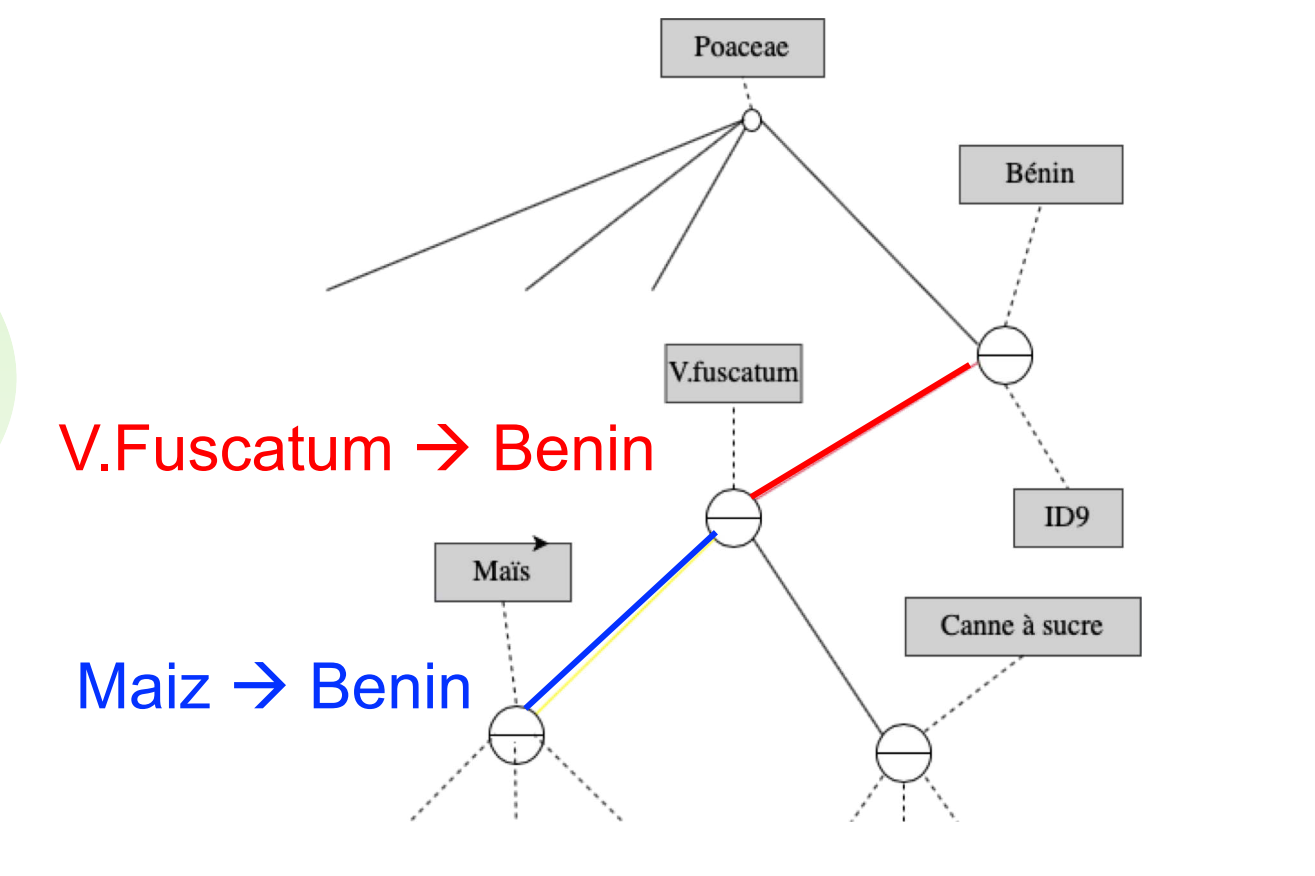


Fig 2. Example of rules on an FCA lattice

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

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