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# The Vitis Ontology: sustainable and FAIR (Findable, Accessible, Interoperable, Reusable) for consistent and complete data description through biologist friendly ontologies

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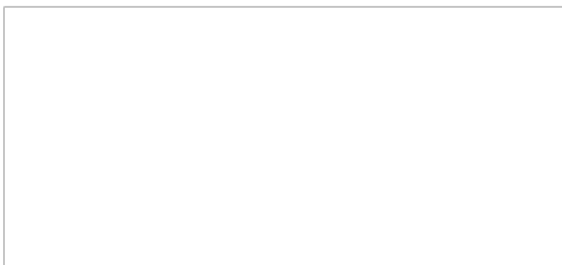
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# The *Vitis* Ontology

Sustainable and FAIR (Findable, Accessible, Interoperable, Reusable)  
for consistent and complete data description through biologist  
friendly ontologies

Éric Duchêne, SVQV, INRA Colmar, France

Cyril Pommier, URGI, INRA Versailles, France



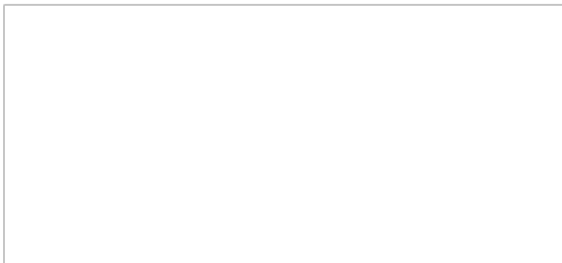
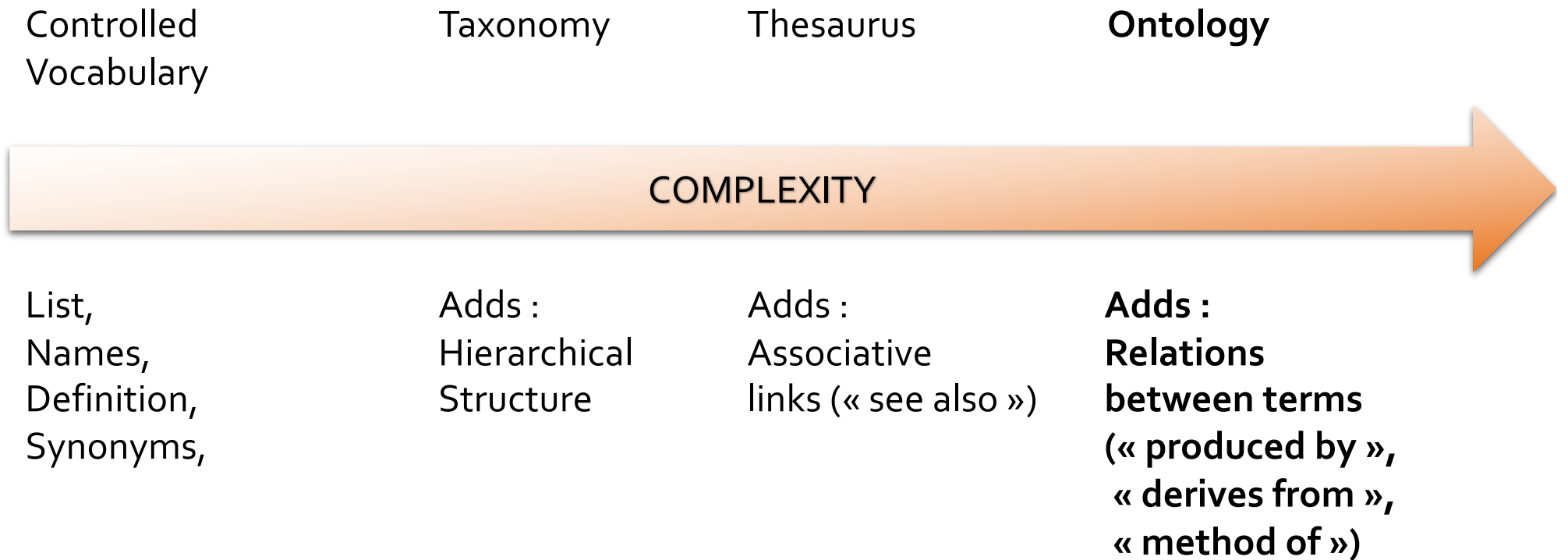
# What are ontologies?

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- Ontology is a data model **representative of a set of concepts in a domain, as well as relationships between these concepts**
- « Ontology is to data what grammar is to language »
- Concepts are organized in a graph where relationships can be:
  - ✓ Semantic relationships
  - ✓ Hierarchical relationships.

Source: Wikipedia

# What are ontologies?



# A well-known ontology: the Gene ontology

## Drill-down Browsing of Ontologies ?

### Filter tree gene products

Total gene products: **1172459**

No current user filters.

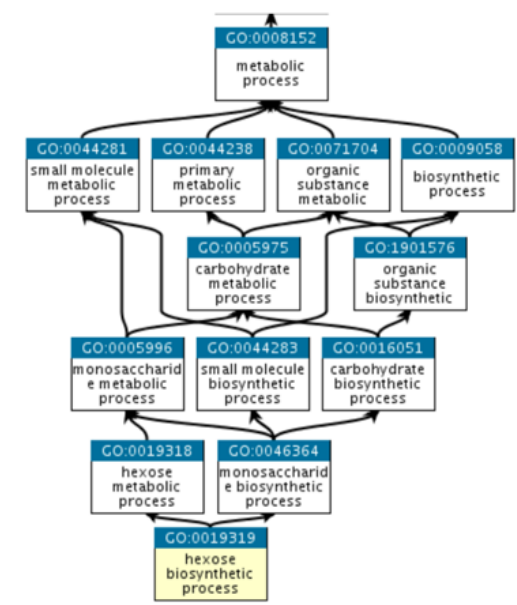
#### Your search is pinned to these filters

- document\_category: bioentity

Organism

Type

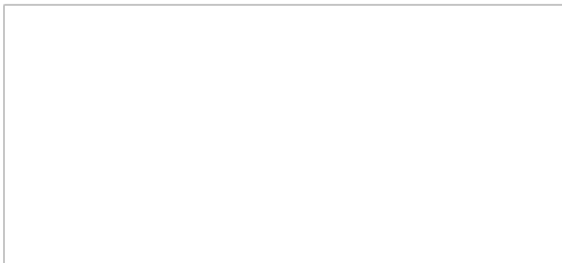
- biological\_process **954115**
  - actin filament polymerization **3553**
  - behavior **6118**
  - binding **1286**
  - biological adhesion **14543**
  - biological phase **103**
    - cell cycle phase **0**
      - G1 phase **0**
      - G2 phase **0**
      - M phase **0**
      - S phase **0**
      - anaphase **0**
      - cell quiescence **0**
      - interphase **0**
      - meiotic cell cycle phase **0**
      - metaphase **0**
      - mitotic cell cycle phase **0**
      - prophase **0**
      - telophase **0**
    - estrous cycle phase **0**
    - hair cycle phase **103**
    - menstrual cycle phase **0**
    - single-celled organism vegetative growth phase **0**
  - biological regulation **298907**



# Why to use ontologies?

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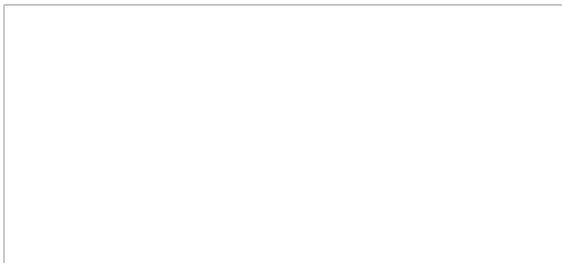
- To share a common vocabulary among a scientific community,
- To standardize data description
  - Leaf  $\neq$  leaves  $\neq$  L  $\neq$  feuille
- To share information and data,
- To facilitate comparisons and meta analyses.



# How to describe phenotypic data ?

---

- Describe the experiment,
- Describe the plant material,
- Describe the data and how they were obtained,



# How to describe phenotypic data ?

---

- Use data standards
  - Semantic
    - Description of the data **key concepts (the description of the data itself is more in the metadata)**
    - Controlled vocabularies: term name and definitions
    - Ontologies: semantic links between terms
    - *Biologist driven*
  - Reuse
    - Formatting and Organizing the data
    - **Format Standards** : CSV, VCF, GFF,
    - **Metadata Standards** (about their production): MIAPPE\_ ([www.miappe.org](http://www.miappe.org)) , etc...
    - *Biologist & Computer scientist driven*
  - Technical **infrastructure**
    - Data integration and sharing
    - Interoperability : tools and databases (GA4GH, Breeding API [www.brapi.org](http://www.brapi.org) )
    - *Computer scientist driven*



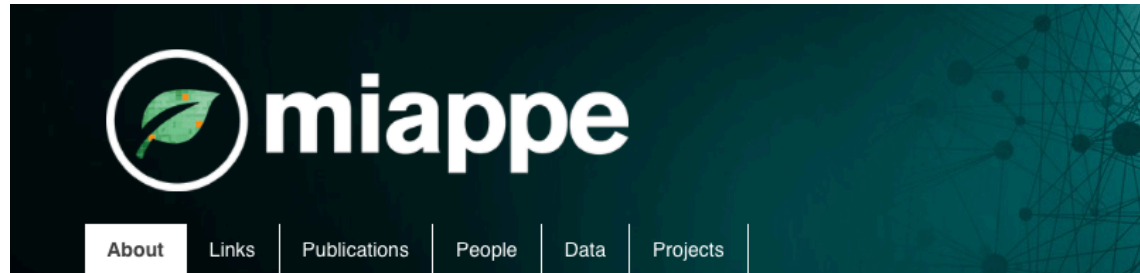
# Describing the experiment

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- Who was in charge of the experiment?
- What were the objectives?
- What were the objects to compare ? What kind of treatments were applied ?
- What was the statistical design?



# Describing the experiment: the MIAPPE project

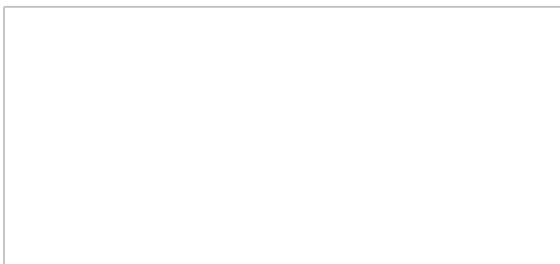


<https://www.miappe.org>

MIAPPE

Minimum Information About a Plant Phenotyping Experiment

« Defines a list of attributes that might be necessary to fully describe a phenotyping experiment, following the model originally established for microarray data »



# Describing the experiment: the MIAPPE project

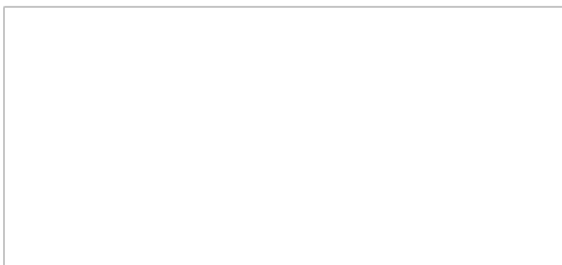
MIAPPE					
line #	MIAPPE Check list	Definition	Example	Format	Cardinality
DM-1	<b>Investigation</b>	Investigations are research programmes with defined aims. They can exist at various scales (for example, they could encompass a grant-funded programme of work, the various components comprising a peer-reviewed publication, or a single experiment).			1 per MIAPPE submission
DM-2	<b>Investigation unique ID</b>	Identifier comprising the unique name of the institution/database hosting the submission of the investigation data, and the accession number of the investigation in that institution.	EBI:12345678	Unique identifier	0-1
DM-3	<b>Investigation title</b>	Human-readable string summarising the investigation.	Adaptation of Maize to Temperate Climates: Mid-Density Genome-Wide Association Genetics and Diversity Patterns Reveal Key Genomic Regions, with a Major Contribution of the Vgt2 (ZCN8) Locus.	Free text (short)	1
DM-4	<b>Investigation description</b>	Human-readable text describing the investigation in more detail.	The migration of maize from tropical to temperate climates was accompanied by a dramatic evolution in flowering time. To gain insight into the genetic architecture of this adaptive trait, we conducted a 50K SNP-based genome-wide association and diversity investigation on a panel of tropical and temperate American and European representatives.	Free text	0-1
DM-5	<b>Submission date</b>	Date of submission of the dataset presently being described to a host repository.	2012-12-17	Date/Time (ISO 8601, optional time zone)	0-1
DM-6	<b>Public release date</b>	Date of first public release of the dataset presently being described.	2013-02-25	Date/Time (ISO 8601, optional time zone)	0-1
DM-7	<b>License</b>	License for the reuse of the data associated with this investigation. The Creative Commons licenses cover most use cases and are recommended.	CC BY-SA 4.0, Unreported	Unique identifier	0-1
DM-8	<b>MIAPPE version</b>	The version of MIAPPE used.	1.1	Version number	1
DM-9	<b>Associated publication</b>	An identifier for a literature publication where the investigation is described. Use of DOIs is recommended.	doi:10.1371/journal.pone.0071377	DOI	0+
DM-10	<b>Study</b>	A study (or experiment) comprises a series of assays (or measurements) of one or more types, undertaken to answer a particular biological question.			1+ per investigation
DM-11	<b>Study unique ID</b>	Unique identifier comprising the name or identifier for the institution/database hosting the submission of the study data, and the identifier of the study in that institution.	EBI:12345678 http://phenome-fppn.fr/maugio/2013/12351	Unique identifier	0-1

[https://github.com/MIAPPE/MIAPPE/blob/master/MIAPPE\\_Checklist-Data-Model-v1.1/MIAPPE\\_Checklist-Data-Model-v1.1.pdf](https://github.com/MIAPPE/MIAPPE/blob/master/MIAPPE_Checklist-Data-Model-v1.1/MIAPPE_Checklist-Data-Model-v1.1.pdf)

# Describing the experiment: the MIAPPE project

DM-60	<b>Experimental Factor</b>	The object of a study is to ascertain the impact of one or more factors on the biological material. Thus, a factor is, by definition a condition that varies between observation units, which may be biotic (pest, disease interaction) or abiotic (treatment and cultural practice) in nature. Depending on the level of the data, an experimental factor can be either "what is the factor applied to the plant" (ie Unwatered), or the "environmental characterisation" (ie if no rain on unwatered plant : Drought ; if rain on unwatered plant: Irrigated)			0+ per study; 0+ per observation unit
DM-61	<b>Experimental Factor type</b>	Name/Acronym of the experimental factor.	Watering	Free text (see Appendix II)	1
DM-62	<b>Experimental Factor description</b>	Free text description of the experimental factor. This include all relevant treatments planification and protocol planed for all the plant targeted by a given experimental factor.	Daily watering 1 L per plant.	Free text	0-1
DM-63	<b>Experimental Factor values</b>	List of possible values for the factor.	Watered; Unwatered	Free text	2+ per factor
DM-64	<b>Event</b>	An event is discrete occurrence at a particular time in the experiment (which can be natural, such as rain, or unnatural, such as planting, watering, etc). Events may be the realization of Factors or parts of Factors, or may be confounding to Factors. Can be applied at the whole study level or to only a subset of observation units.			0+ per study/observation unit
DM-65	<b>Event type</b>	Short name of the event.	Planting Fertilizing	Free text (short)	1
DM-66	<b>Event accession number</b>	Accession number of the event type in a suitable controlled vocabulary (Crop Ontology).	CO_715:0000007 CO_715:0000011	Crop Ontology term (subclass of CO_715:0000006)	0-1
DM-67	<b>Event description</b>	Description of the event, including details such as amount applied and possibly duration of the event.	Sowing using seed drill Fertilizer application: Ammonium nitrate at 3 kg/m2	Free text	0-1
DM-68	<b>Event date</b>	Date and time of the event.	2006-09-27T10:23:21+00:00 2006-10-27; 2006-11-13; 2016-11-21	Date/Time (ISO 8601, optional time zone)	1+
DM-69	<b>Observation Unit</b>	Observation units are objects that are subject to particular instances of observation and measurement. An observation unit comprises one or more plants, and their environment. <i>Synonym: Experimental unit.</i>			1+ per study
DM-70	<b>Observation unit ID</b>	Identifier used to identify the observation unit in data files containing the values observed or measured on that unit. Must be locally unique.	plot:894	Unique identifier	1
DM-71	<b>Observation unit type</b>	Type of observation unit in textual form, usually one of the following: block, sub-block, plot, plant, trial, pot, replication or replicate, individual, virtual_trial, unit-parcel	plot	Free text	1

[https://github.com/MIAPPE/MIAPPE/blob/master/MIAPPE\\_Checklist-Data-Model-v1.1/MIAPPE\\_Checklist-Data-Model-v1.1.pdf](https://github.com/MIAPPE/MIAPPE/blob/master/MIAPPE_Checklist-Data-Model-v1.1/MIAPPE_Checklist-Data-Model-v1.1.pdf)



# Describing the plant material

<https://www.biodiversityinternational.org/e-library/publications/detail/faobiodiversity-multi-crop-passport-descriptors-v21-mcpd-v21/>



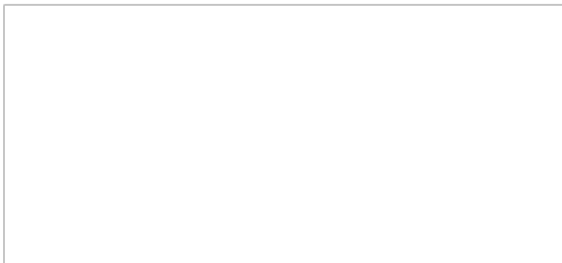
Home About us ▾ Strategy Innovations ▾ Research ▾

Home / e-Library / Publications

## FAO/Biodiversity Multi-Crop Passport Descriptors V.2.1 [MCPD V.2.1]

*December 2015*

MIAPPE iv-cludes



É.Duchêne - COST Integrate March 2019



# Describing the plant material

## MULTI-CROP PASSPORT DESCRIPTORS

### 0. Persistent unique identifier

(PUID)

Any persistent, unique identifier assigned to the accession so it can be unambiguously referenced at the global level and the information associated with it harvested through automated means. Report one PUID for each accession.

The Secretariat of the International Treaty on Plant Genetic Resources for Food and Agriculture (PGRFA) is facilitating the assignment of a persistent unique identifier (PUID), in the form of a DOI, to PGRFA at the accession level (<http://www.planttreaty.org/doi>).

Genebanks not applying a true PUID to their accessions should use, and request recipients to use, the concatenation of INSTCODE, ACCENUMB, and GENUS as a globally unique identifier similar in most respects to the PUID whenever they exchange information on accessions with third parties (e.g. NOR017:NGB17773:ALLIUM).

### 1. Institute code

(INSTCODE)

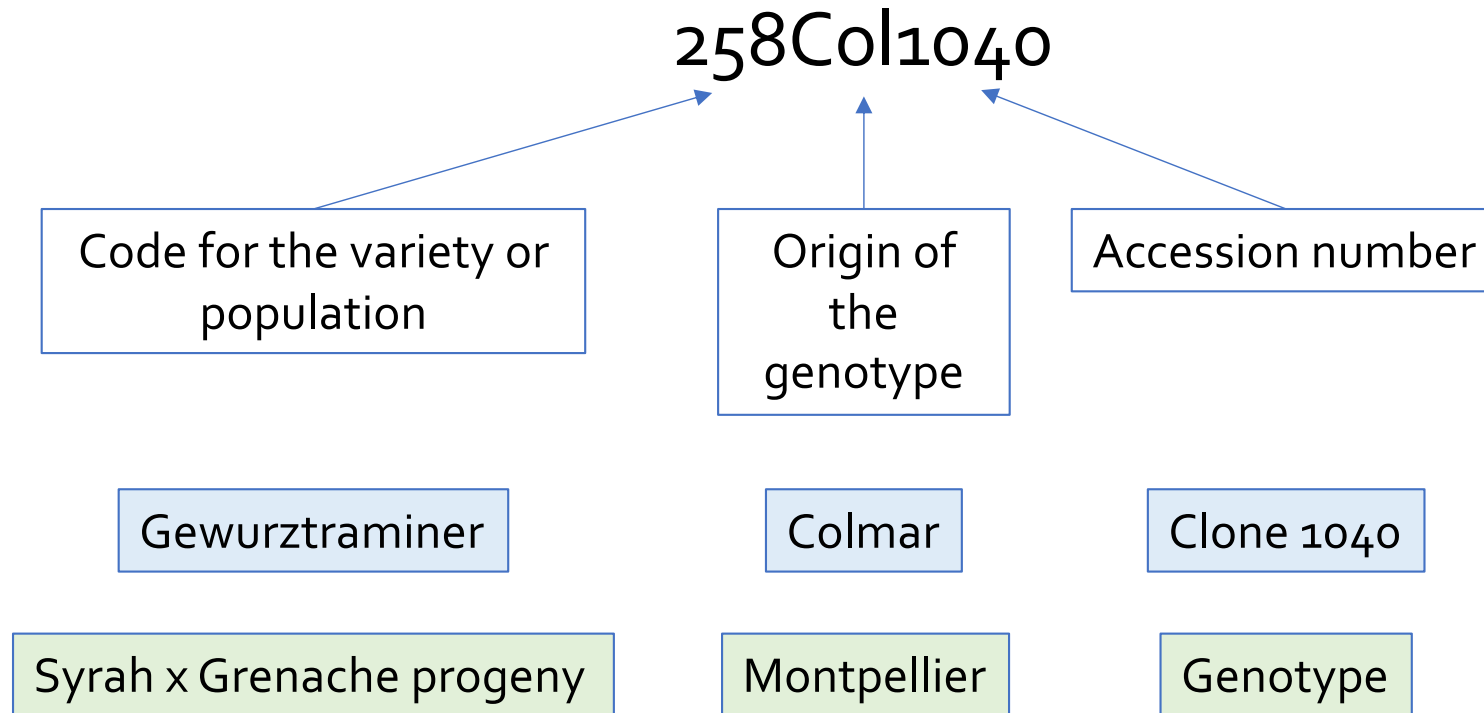
FAO WIEWS code of the institute where the accession is maintained. The codes consist of the 3-letter ISO 3166 country code of the country where the institute is located plus a number (e.g. COL001). The current set of institute codes is available from <http://www.fao.org/wiews>. For those institutes not yet having an FAO Code, or for those with 'obsolete' codes, see '*Common formatting rules (v)*'.

### 2. Accession number

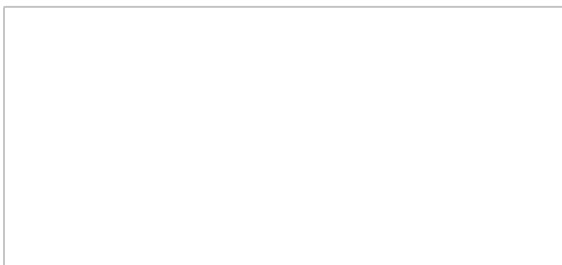
(ACCENUMB)

This is the unique identifier for accessions within a genebank, and is assigned when a sample is entered into the genebank collection (e.g. 'PI 113869').

# Describing the plant material: exemple for the grapevine accession number



23297Mtp13



# Describing a variable: a general approach

Principles for the « crop ontology »

<http://www.croponontology.org>

*1 variable = {1 trait, 1 method, 1 scale}*

The essence of the CO model is to decompose a variable recorded by the breeders into:

- A **trait**: “what is observed”
- A **method**: “how the observation is made”
- A **scale**: “how the observation is expressed”

In other words, **a variable is the combination of 1 trait, 1 method and 1 scale**. To illustrate this, the Table 2 shows the breakdown of the PH, GCOL and GY examples.

**Table 2: Breakdown of PH, GCOL and GY into trait, method and scale**

Variable	Trait	Method	Scale
PH	The distance from the ground to the top of the canopy	Measured with a ruler	cm
GCOL	Color of the grain	Visually assessed	5-category color scale
GY	Yield of dehulled grain	Divide harvested grain weight by plot surface	g/m <sup>2</sup>

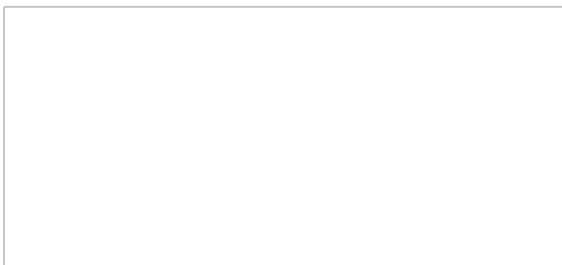


# Describing a variable: for the grapevine

---

[http://www.croponontology.org/ontology/CO\\_356/Vitis](http://www.croponontology.org/ontology/CO_356/Vitis)

- **a trait**, like pruning weight or flowering date,
- **a method** that describes how the trait was measured, *i.e.* with a scale or computed through image analysis,
- **a scale/unit** : *i.e.* . International system units like centimeter or meter, or notation scale like late, early, etc...
  - Built with scientist from INRA in France
  - 273 variables available



# The *Vitis* Ontology: structure

## Crop Ontology Curation Tool

[Home](#) [About](#) [Feedback](#)

CO\_356

Add New Term

CO\_356

Add New Terms

### Traits, methods and scales

DOWNLOAD SHOW OBSOLETE TERMS English

- VITIS traits
  - Abiotic stress is\_a
  - Agronomical is\_a
  - Biochemical is\_a
  - Biotic stress is\_a
  - Morphological is\_a
  - Phenological is\_a
  - Technological is\_a

### Traits, methods and scales

DOWNLOAD SHOW OBSOLETE TERMS English

- VITIS traits
  - Abiotic stress is\_a
  - Agronomical is\_a
    - Diameter of internodes is\_a
    - Dry weight per shoot is\_a
    - Exposed leaf area is\_a
    - Internode length is\_a
    - Leaf area is\_a
    - Node number of the first tendril above the cotyledon is\_a
    - Number of buds left after pruning is\_a
    - Number of canes is\_a

### Traits, methods and scales

DOWNLOAD HIDE OBSOLETE TERMS English

- VITIS traits
  - Abiotic stress is\_a
  - Agronomical is\_a
    - Diameter of internodes is\_a
    - Dry weight per shoot is\_a
      - No method name found method\_of
    - Exposed leaf area is\_a
    - Internode length is\_a
    - Leaf area is\_a
    - Node number of the first tendril above the cotyledon is\_a
    - Number of buds left after pruning is\_a
    - Number of canes is\_a
    - Number of clusters is\_a
    - Number of inflorescences (All) is\_a

### Variables

SHOOT\_DW

# The *Vitis* Ontology: structure

## Traits, methods and scales

DOWNLOAD SHOW OBSOLETE TERMS English

- Concentrations of free and bound nerol is\_a
- Free SO2 is\_a
- Glucose and fructose is\_a
- Malic acid concentration is\_a
- Potassium concentration is\_a
- Residual sugar is\_a
- Sugar is\_a
- Tartaric acid concentration is\_a
- Titrateable acidity** is\_a
- No method name found method\_of
  - meq/l scale\_of
- No method name found method\_of
- No method name found method\_of
- Total SO2 is\_a
- Total acid of must is\_a

## Variables

BERRY\_TA

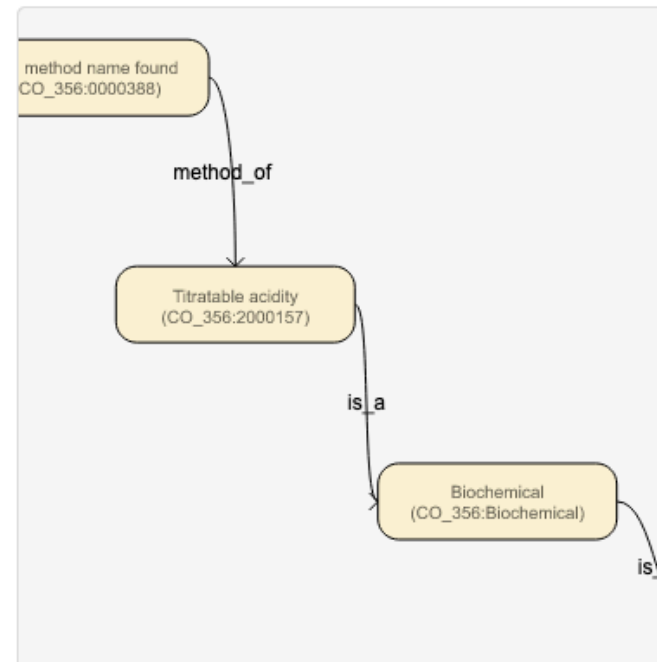
## Term information

No method name found Permalink

Identifier **CO\_356:0000388**

created\_at Wed Jul 12 14:29:20 UTC 2017

[Add a new attribute](#)



# The *Vitis* Ontology: structure

All the OIV descriptors are included

## Traits, methods and scales

DOWNLOAD SHOW OBSOLETE TERMS English

- Percentage of berries destroyed by Downy Mildew
- Percentage of berries with grey rot
- Percentage of berries with noble rot
- Percentage of berries with
- Resistance to Botrytis (Cluster)
- Resistance to Botrytis (Leaf)
- Resistance to Eutypa dieback Eutypa
- Resistance to Oidium (Cluster)**
- OIV:456 method\_of
  - S1\_9\_by2 scale\_of
- Resistance to Oidium (Leaf)
- Resistance to Plasmopara (Cluster)
- Resistance to Plasmopara (Leaf)
- Surface of foliage attacked by Downy Mildew

## Variables

UN\_CLUSTER\_OIV

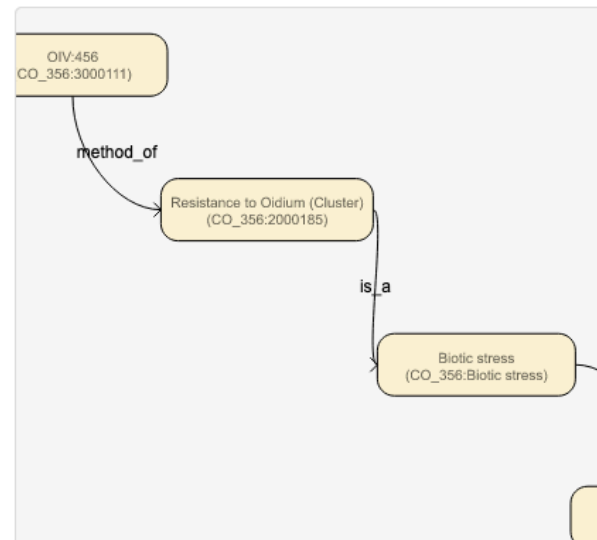
## Term information

OIV:456 Permalink Gener

Identifier [CO\\_356:3000111](#)

created\_at Wed Jul 12 14:29:24 UTC 2017

[Add a new attribute](#)



# The *Vitis* Ontology: use-case



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Preferences

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GnpIS

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- GENETIC MAPS
- POLYMORPHISMS
- ASSOCIATION
- PLANT SYNTENY
- TRANSCRIPTOMIC

## Ontologies

Traits, methods and scales English **FLO\_START: Flowering start** VARIABLE

Search terms...

- Biotic stress TRAIT CLASS
- Morphological TRAIT CLASS
- Phenological TRAIT CLASS
  - Budbreak TRAIT
  - Flowering TRAIT
    - DOY\_FLO: Day of Year Flowering (50%)
    - FLO\_50: Flowering date (50%) VARIABLE
    - FLO\_END: Flowering end VARIABLE
    - FLO\_OIV: OIV: Time of full bloom VARIABLE
    - FLO\_START: Flowering start VARIABLE
    - HS\_Tmax\_B10\_BudFlo: Heat sums with
    - MI-FLO-relatif: Flowering date (50%) rel
  - Maturity TRAIT
  - Number of leaves TRAIT
  - Number of sprouted buds TRAIT

**Ontology name** Vitis infra ontology

**Identifier** CO\_356:1000083

**Name** FLO\_START

**Synonyms** Flowering start

**Institution** INRA

**Scientist** Eric Duchene

**Crop** VITIS

**Flowering** TRAIT

**Identifier** CO\_356:2000001

**Name** Flowering

**Entity** Plant

**Attribute** Flowering

**Class** Phenological

**FLO\_START Method** METHOD

**Identifier** CO\_356:3000169

**Name** FLO\_START Method

**Class** Estimation

**Calendar date** SCALE

**Identifier** CO\_356:4000003

**Name** Calendar date

**Data type** Time



# The *Vitis* Ontology: use-case



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- ASSOCIATION
- PLANT SYNTENY
- TRANSCRIPTOMIC

## Ontologies

Traits, methods and scales English **BERRY\_TA: Berry Titratable acidity** VARIABLE

Search terms...

- Glucose and fructose TRAIT
- Malic acid concentration TRAIT
- Potassium concentration TRAIT
- Residual sugar TRAIT
- Sugar TRAIT
- Tartaric acid concentration TRAIT
- Titratable acidity TRAIT
  - BERRY\_TA: Berry Titratable acidity** VARIABLE
  - MUST\_TA: Must Titratable acidity VARIABLE
  - WINE\_TA: Wine Titratable acidity VARIABLE
- Total Phenolic TRAIT
- Total SO2 TRAIT
- Total acid of must TRAIT
- Total soluble solids TRAIT
- must specific pH TRAIT
- pH TRAIT

**Ontology name** Vitis infra ontology  
**Identifier** CO\_356:1000231  
**Name** BERRY\_TA  
**Synonyms** Berry Titratable acidity  
**Institution** INRA  
**Scientist** Eric Duchene  
**Crop** VITIS

**Titratable acidity** TRAIT  
**Identifier** CO\_356:2000157  
**Name** Titratable acidity  
**Description** Necessary complement: Sampling date  
**Entity** Berry  
**Attribute** Acidity  
**Class** Biochemical

**BERRY\_TA Method** METHOD  
**Identifier** CO\_356:3000153  
**Name** BERRY\_TA Method  
**Class** Measurement

**meq/l** SCALE  
**Identifier** CO\_356:4000012  
**Name** meq/l  
**Data type** Numerical



# The *Vitis* Ontology: use-case

<https://urgi.versailles.inra.fr/ephep/ephep/viewer.do#dataResults/trialSetIds=23>

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## Phenotypes


Back to Form

Search parameter(s): DATA SETS: 1

Project Data Set : [RoxGW](#)

Trial(s): RIGW section I  
 Genus: Vitis  
 Variable(s): CO\_356:1000011  
 Number of Panel(s): 1

Geolocation 📍



Origin site 📍 Collecting site 📍 Evaluation site 📍

Phenotyping campaign(s) 2009 remove all add all

Trial list Phenotypic data

Data table view: Default

LEVEL: BLOCK > PLOT

371-376 of 376 plot | Display 10 results per page

trial	Trial Site	LEVEL BLOCK	LEVEL PLOT	X Rank	Y Stock	Campaign	VARIABLE FLO_59: Flowering date (59%)
<a href="#">:lion.I</a>	Bergheim Burlenberg	2	26427	19	16	2009	2009-06-05
<a href="#">:lion.I</a>	Bergheim Burlenberg	2	26366	17	14	2009	2009-06-05
<a href="#">:lion.I</a>	Bergheim Burlenberg	1	26482	21	6	2009	2009-06-04
<a href="#">:lion.I</a>	Bergheim Burlenberg	3	26707	28	36	2009	2009-06-05
<a href="#">:lion.I</a>	Bergheim Burlenberg	3	26285	14	32	2009	2009-06-05
<a href="#">:lion.I</a>	Bergheim Burlenberg	3	26585	24	32	2009	2009-06-07

Ephes data export
Ephes MIAPPE ISA-Tab export

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É.Duchêne - COST Integrate March 2019



# The woody plant ontology: an example to follow



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## Ontologies

Traits, methods and scales English **LCC: Leaf chlorophyll content** VARIABLE

Search terms...

- Content of Saccharose in the leaf TRAIT
- Delta cadidene content TRAIT
- Enzymatic activity of Glutamine TRAIT
- Enzymatic activity of glycolate oxydase TRAIT
- Enzymatic activity of hydroxypyruvate reducta
- Enzymatic activity of phosphoenolpyruvate ca
- Gamma cadidene content TRAIT
- Germacrene content TRAIT
- Hemicellulose wood composition TRAIT
- Hydroxyphenylaldehyde/Syringaldehyde/Coni
- Leaf chlorophyll content TRAIT
- LCC: Leaf chlorophyll content** VARIABLE
- Limonene content TRAIT
- Polyphenols cork composition TRAIT
- Polysacharide cork composition TRAIT

<b>Ontology name</b>	Woody Plant Ontology
<b>Identifier</b>	CO_357:0000248
<b>Name</b>	LCC
<b>Synonyms</b>	Leaf chlorophyll content LCC[Adonis]
<b>Context of use</b>	QTL analysis
<b>Status</b>	Standard for INRA
<b>Institution</b>	INRA
<b>Scientist</b>	Célia Michotey
<b>Date</b>	20/02/2018
<b>Crop</b>	WoodyPlant

**Leaf chlorophyll content** TRAIT

<b>Identifier</b>	CO_357:1000207
<b>Name</b>	Leaf chlorophyll content
<b>Description</b>	Leaf chlorophyll content
<b>Main abbreviation</b>	LCC
<b>Entity</b>	leaf
<b>Attribute</b>	chlorophyll content
<b>Status</b>	Standard for INRA
<b>Class</b>	Biochemical

**Leaf chlorophyll content protocol** METHOD

<b>Identifier</b>	CO_357:2000096
<b>Name</b>	Leaf chlorophyll content protocol
<b>Description</b>	Chlorophyll content was measured twice a week from 6 days before water-logging to 47 days of treatment. Measurements were made on 3 fully developed leaves of the last growth flush before water-logging on each tree using a chlorophyll content



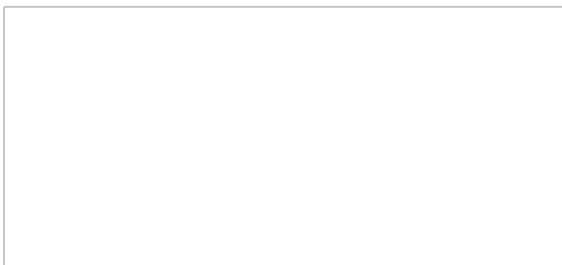


# The *Vitis* Ontology: use-case

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Examples for woody plants

- <https://urgi.versailles.inra.fr/ephep/ephep/viewer.do#dataResults/trialSetIds=15>
- <https://urgi.versailles.inra.fr/ephep/ephep/viewer.do#dataResults/trialSetIds=24> .



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## Phenotypes

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[Geolocation](#)

DATA SETS: 2

Network Data Set :

[PlantaComp](#)

Network Data Set :

[PlantaComp Pinus pinea](#)



Leaflet | Tiles © Esri — Source: Esri, DeLorme, NAVTEQ, USGS, Intermap, IPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012

[Origin site](#) [Collecting site](#) [Evaluation site](#)

Phenotyping campaign(s)

No campaign	1991	1992	1993	1994	1995	1996	1997	
1998	1999	2000	2001	2002	2003	2004	2005	2006
2009	2010	2011	2012	2016	unknown			

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## Phenotypes

### Integrating genome annotation and QTL position to identify candidate genes for productivity, architecture and water-use efficiency in *Populus* spp

Romain Monclus, Jean-Charles Leplé, Catherine Bastien, Pierre-François Bert, Marc Villar, Nicolas Marron, Franck Brignolas, Véronique Jorge

Published 2012 by Springer Nature

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Geolocation

DATA SETS: 1

Project Data Set :

[POPYOMICS](#)

DOI:<http://dx.doi.org/10.1186/1471-2229-12-173>

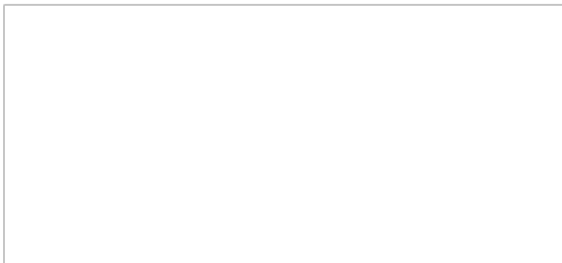


Leaflet | Tiles © Esri — Source: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012

# To conclude

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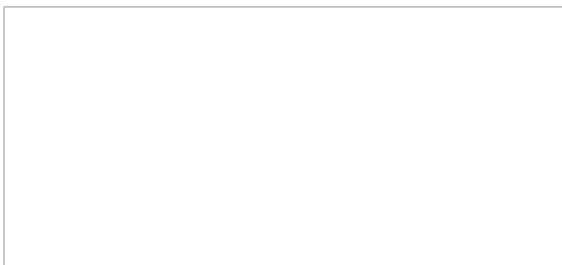
- There are existing standards for describing an experiment, the plant material and phenotyping variables,
- For the grapevine, the *Vitis ontology* is ready to be used by the international scientific community



# Thanks to...

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- French scientists that helped to build to ontology,
- The URGI Team (Anne-Françoise Adam-Blondon's team),
- The Bioversity International team for the [cropontology.org](http://cropontology.org) (Elizabeth Arnaud, Marie-Angélique Laporte).



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Thank you for your attention

É.Duchêne - COST Integrate March 2019





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## Ontologies

Traits, methods and scales

 English 

Search terms...

- Single berry weight TRAIT
- Single cluster weight TRAIT
- Single seed weight TRAIT
- Total number of inflorescences/number of primary shoots TRAIT
  - FERT\_PRIM: Total number of inflorescences/number of primary shoots TRAIT
- Total number of shoots TRAIT
- Vigor of shoot growth TRAIT
- Yield TRAIT
- Biochemical TRAIT CLASS
- Biotic stress TRAIT CLASS
- Morphological TRAIT CLASS
- Phenological TRAIT CLASS
- Technological TRAIT CLASS
- Walnut Trait Ontology ONTOLOGY
- Wheat Inra Phenotype Ontology ONTOLOGY

**FERT\_PRIM: Total number of inflorescences/number of primary shoots** VARIABLE

**Ontology name** Vitis inra ontology  
**Identifier** CO\_356:1000267  
**Name** FERT\_PRIM  
**Synonyms** Total number of inflorescences/number of primary shoots  
**Institution** INRA  
**Scientist** Eric Duchene  
**Crop** VITIS

**Total number of inflorescences/number of primary shoots** TRAIT

**Identifier** CO\_356:2000228  
**Name** Total number of inflorescences/number of primary shoots  
**Description** Total number of inflorescences/number of primary shoots  
**Entity** Inflorescence  
**Attribute** Number  
**Class** Agronomical

**FERT\_PRIM Method** METHOD

**Identifier** CO\_356:3000163  
**Name** FERT\_PRIM Method  
**Class** Measurement

**Trial list** **Phenotypic data**

Data table view :

**LEVEL: BLOCK > PLOT > PLANT**

1-10 of 751 plant | Display  results per page

	VARIABLE	VARIABLE	VARIABLE	VARIABLE	
<u>T:</u> <u>er</u>	<u>FERT SPURS: Number of</u> <u>inflorescences per shoot on</u> <u>spurs</u>	<u>FERT GLOB: Number of</u> <u>inflorescences per shoot (all</u> <u>kinds of shoots)</u>	<u>FERT PRIM: Total number of</u> <u>inflorescences/number of</u> <u>primary shoots</u>	<u>NB SHOOT ALL M2: Number</u> <u>of shoots (all) per m2</u>	<u>NB</u>
1	2.1764705	2.642857	8.242424	6.	
1	1.2857143	1.9285715	10.181818	6.	
1	1.7222222	2.3846154	8.727273	6.	
1.5	1.45	2.2307692	9.69697	6.	
1.5	1.4444444	1.8571428	8.727273	6.	
0.5	1.5294118	1.8571428	8.242424	6.	
2	2	2.6153846	8.242424	6.	
1	1.4761904	2.3846154	10.181818	6.	
1.5	1.5263158	2.2307692	9.212121	6.	
1	2	2.5454545	6.787879	5.	



Ephesis data export



Ephesis MIAPPE ISA-Tab export



	A	B	C	D
1	<b>Grapevine anatomy ontology</b>			
2	Eric Duchêne - 14/3/2012			
3				
4	<b>Category</b> ▼	<b>Organ</b> ▼↑	<b>Synonym</b> ▼	<b>in French</b> ▼
5	Reproductive organs	berry		baie
5	Reproductive organs	berry flesh	berry pulp	pulpe
7	Reproductive organs	berry skin		pellicule
3	Vegetative organs	blade		limbe
3	Vegetative organs	bud		œil/bourgeon
0	Perennial organs	cane		long-bois/sarment
1	Reproductive organs	cluster	bunch	grappe
2	Reproductive organs	flower		fleur
3	Perennial organs	grafting point		point de greffe
4	Reproductive organs	green berry		baie verte
5	Reproductive organs	inflorescence		inflorescence
6	Vegetative organs	internode		entrenœud
7	Vegetative organs	lateral branch	axillary shoot	entrecœur
8	Vegetative organs	leaf		feuille
9	Vegetative organs	mature leaf		feuille adulte
0	Perennial organs	node		nœud
1	Perennial organs	old wood		vieux bois
2	Vegetative organs	petiole		petiole