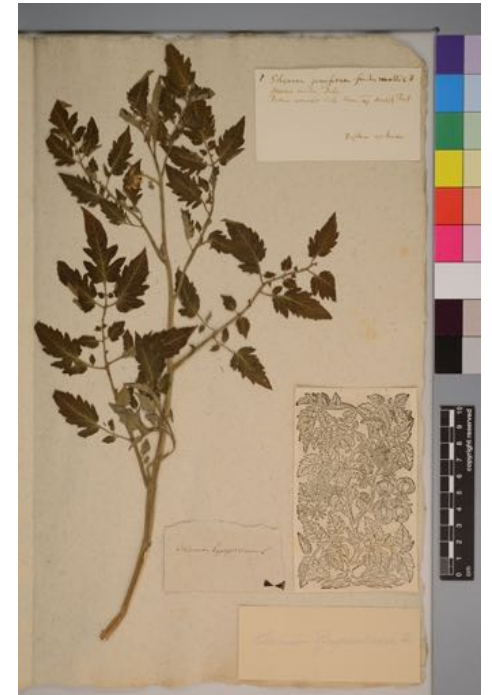


Data standards in practise:

Digitizing “difficult” 16th-18th century herbaria

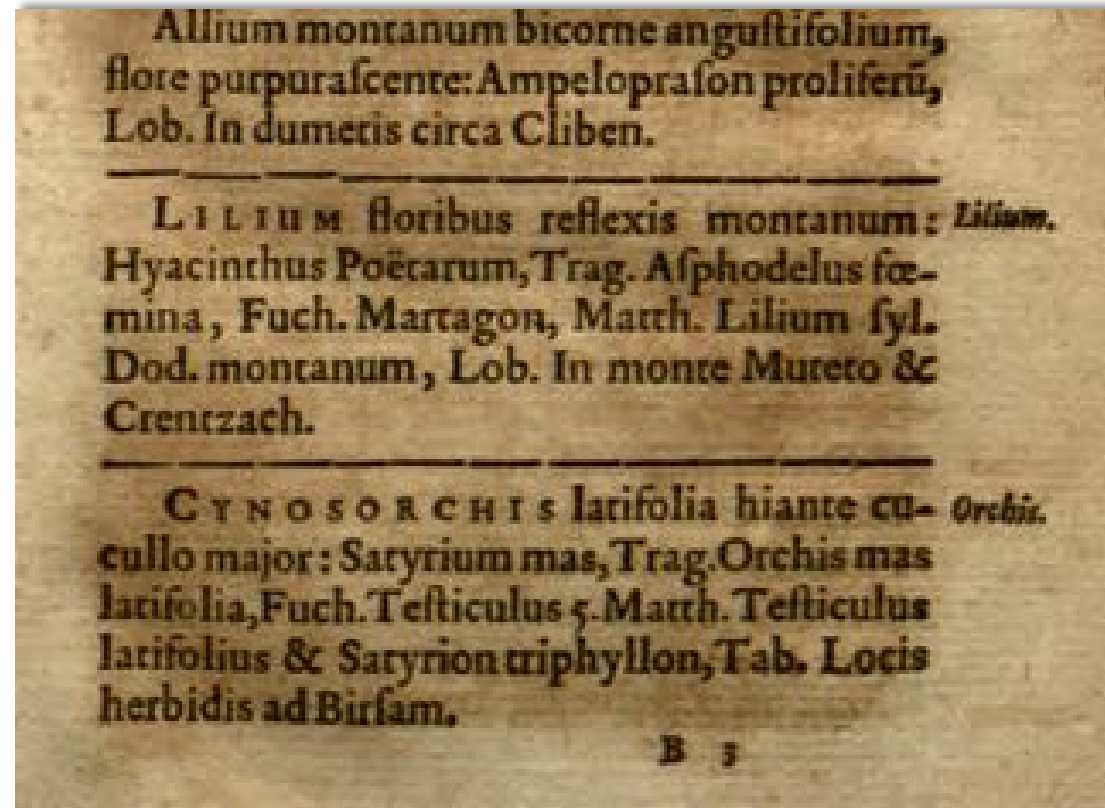
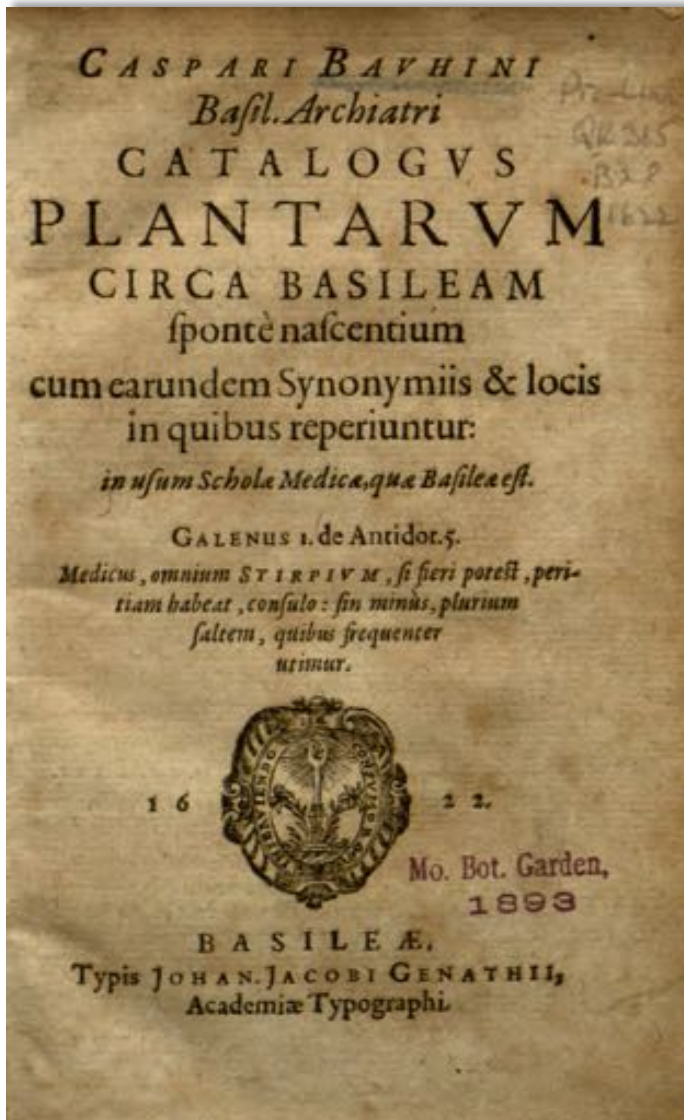


Jurriaan M. de Vos

Principal Curator Herbaria Basel, University of Basel

SwissCollNet Workshop 20. Jan. 2023

Four centuries since Bauhin (1622)



Caspar Bauhin (1560-1624)

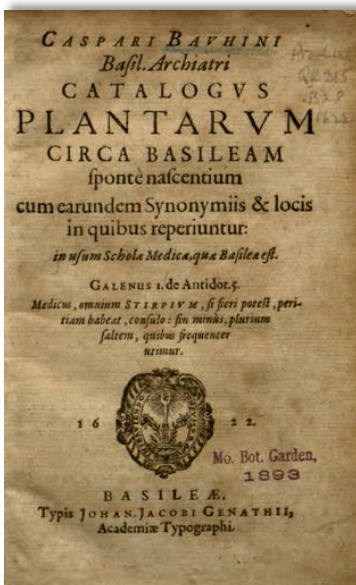


Four centuries since Bauhin (1622)

- Local floras anchor plant diversity in space and time
 - What grows where?
 - What name?
- Development in association with complete compendia
 - Pinax Theatri Botanici, Bauhin (1623)



Caspar Bauhin (1560-1624)



Four centuries of plant collecting

- Local floras anchor plant diversity in space and time
 - What grows where?
 - What name?
- Development in association with complete compendia
 - Pinax Theatri Botanici, Bauhin (1623)
- Requires exchange of plants and ideas
 - Voucher specimens
 - Correspondence networks
 - Assembly of herbaria



Caspar Bauhin (1560-1624)

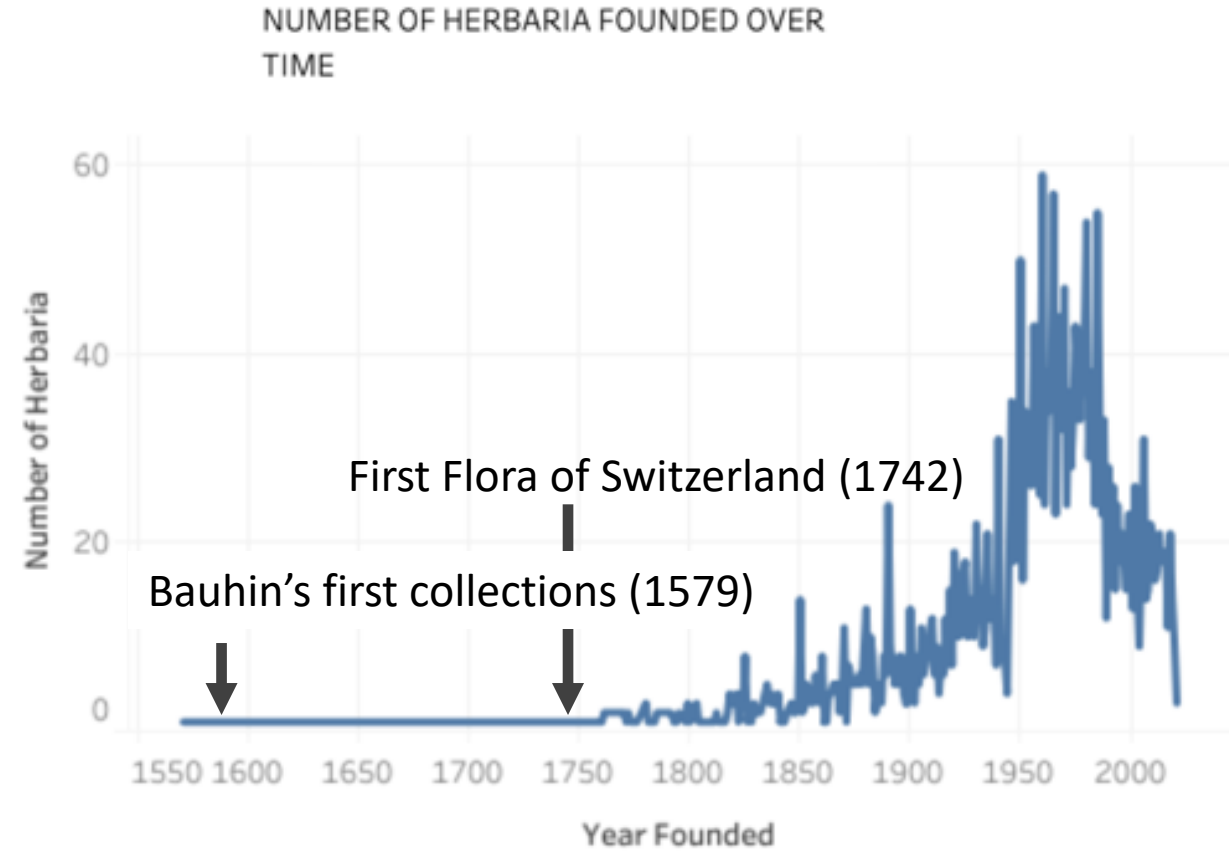
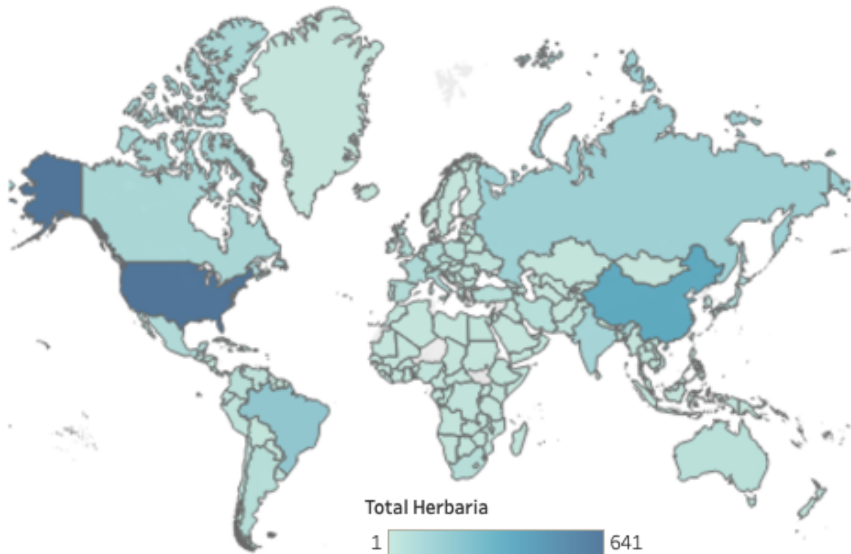




Ca. 9% of the specimens in Caspar Bauhin's herbarium, assembled 1570s – 1620s

Herbaria today

- 3522 herbaria
- 397 million specimens
- All known species (by definition)
- Some 450 years

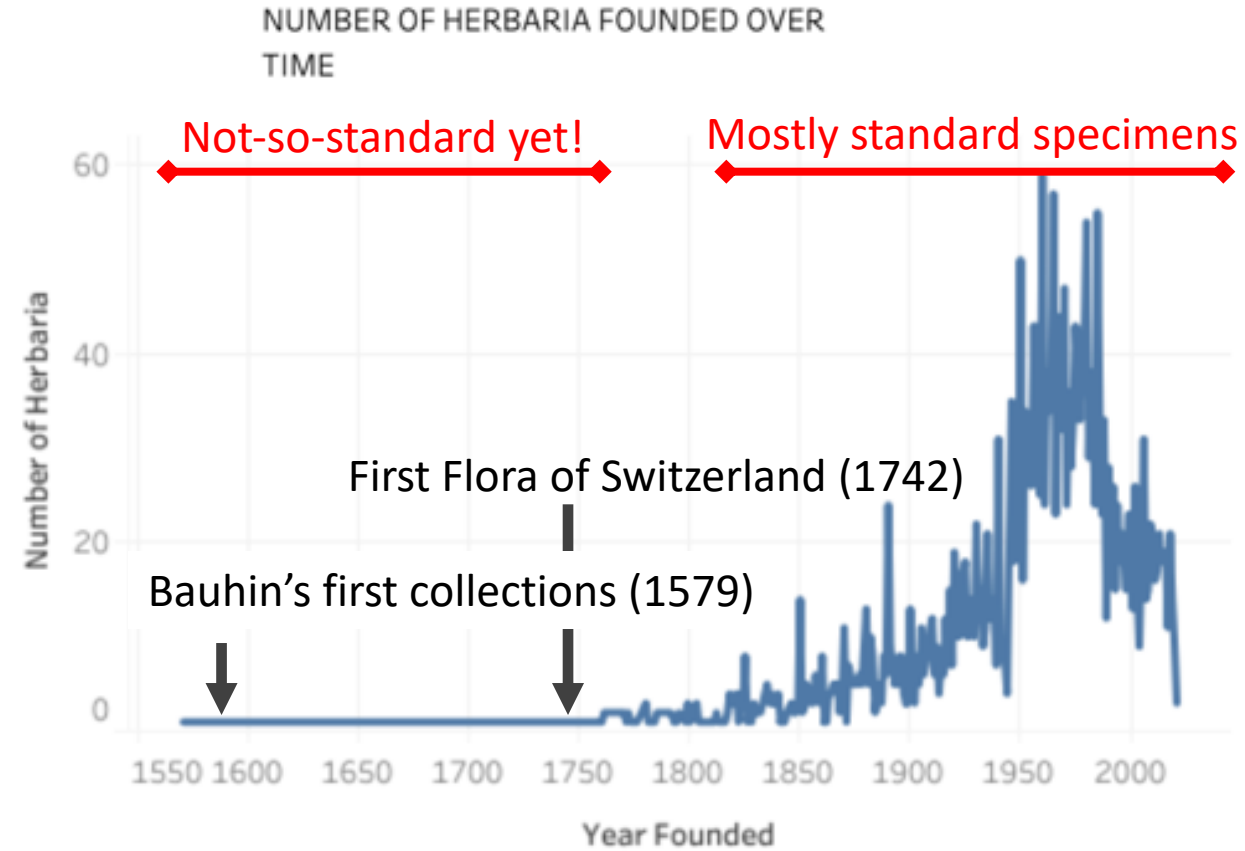
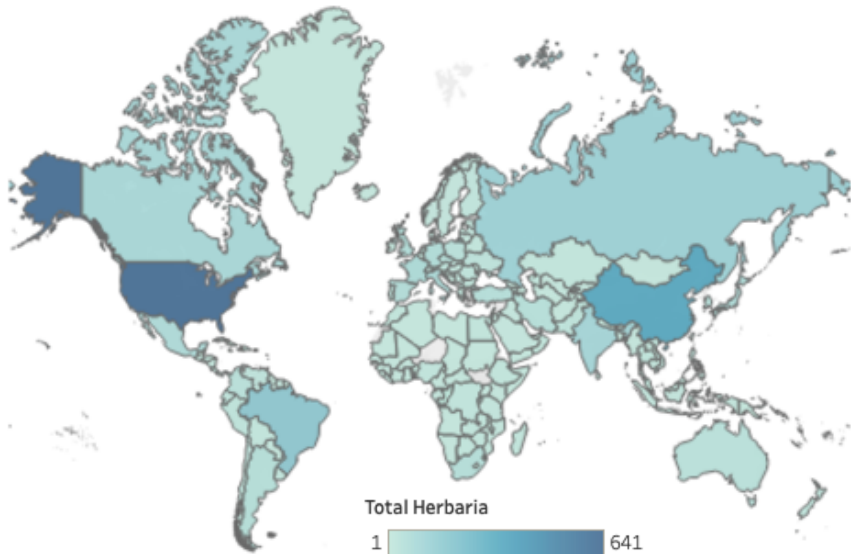


Data: Index Herbariorum annual report 2021



Herbaria today

- 3522 herbaria
- 397 million specimens
- All known species (by definition)
- Some 450 years



Data: Index Herbariorum annual report 2021



One «thing» representing a single gathering in space and time: plant + label



Herbarium: 1000s such things



One «thing» representing a single gathering in space and time: plant + label



«Standard» collections

- (Almost) all pertinent information is visible on the specimen
- Interpretation, where needed is straightforward
- Digitalization: one-by-one
- DarwinCore terms

Record-level::type: physicalObject
Record-level::institutionCode: BASBG
Record-level::basisOfRecord: PreservedSpecimen
Record-level::catalogNumber: 219638
Occurrence::recordedBy: Max Nydegger
Occurrence::recordNumber: s.n.
Taxon::scientificName: Primula halleri J.F.Gmel.
Identification::identifiedBy: Max Nydegger
Event::year: 1973
Event::month: 6
Event::day: 9
Location::country: Switzerland
Location::stateProvince: Valais
Location::municipality: Simplon
Location::verbatimLocality
Location::locality: *neat description interpreted*
Location::decimalLatitude: 46.17461
Location::decimalLongitude: 8.0727
Location::minimumElevationInMeters: 1350
Location::maximumElevationInMeters: 1350



Herbarium Max Nydegger

Flora Helvetica

Primula halleri J.F. Gmelin

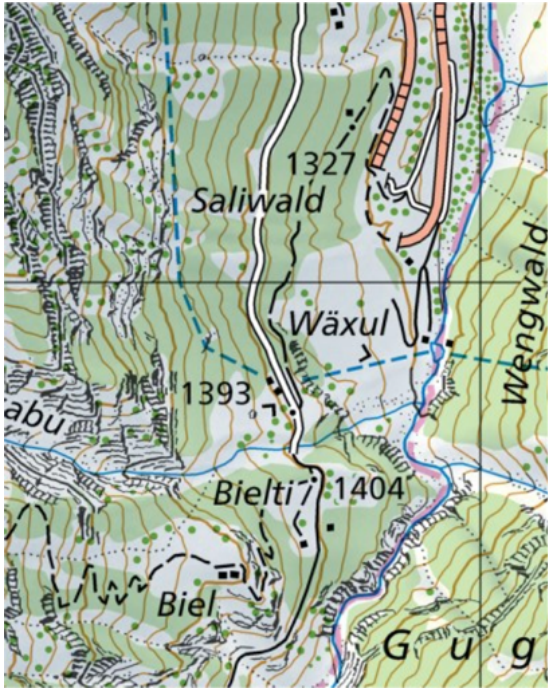
Waldchen auf Blockschutthalde
unter Felsband

V5 Leggintal w Wechsel

9.6.1973

1350 m

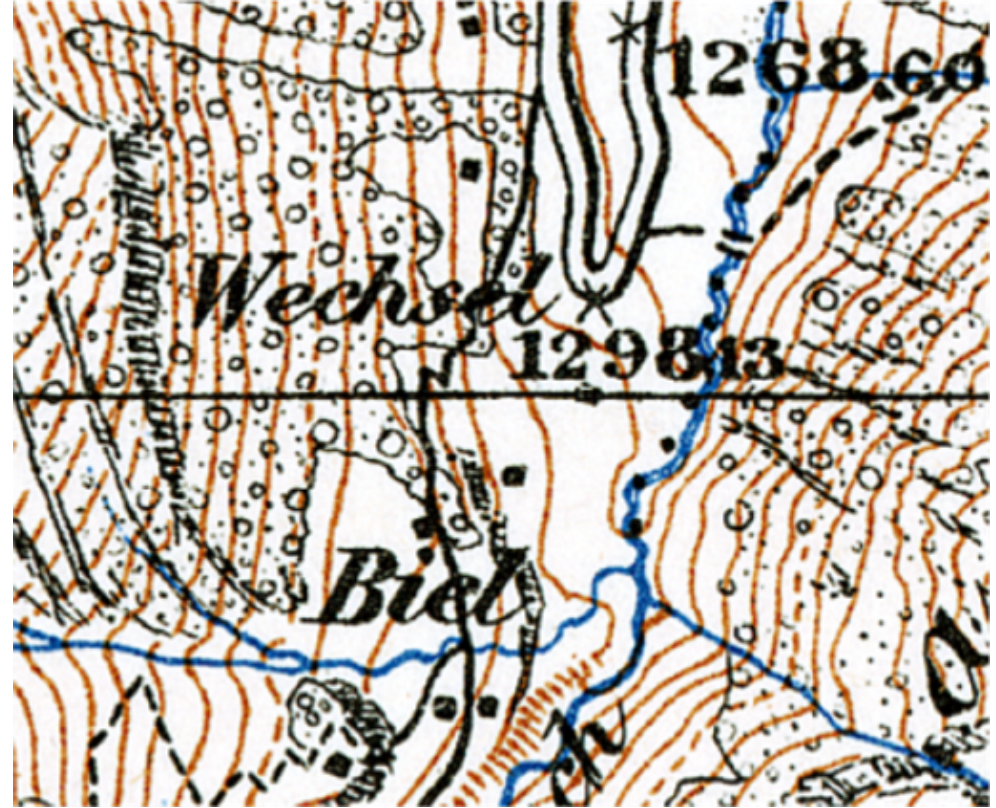
Max Nydegger



Heute



1974

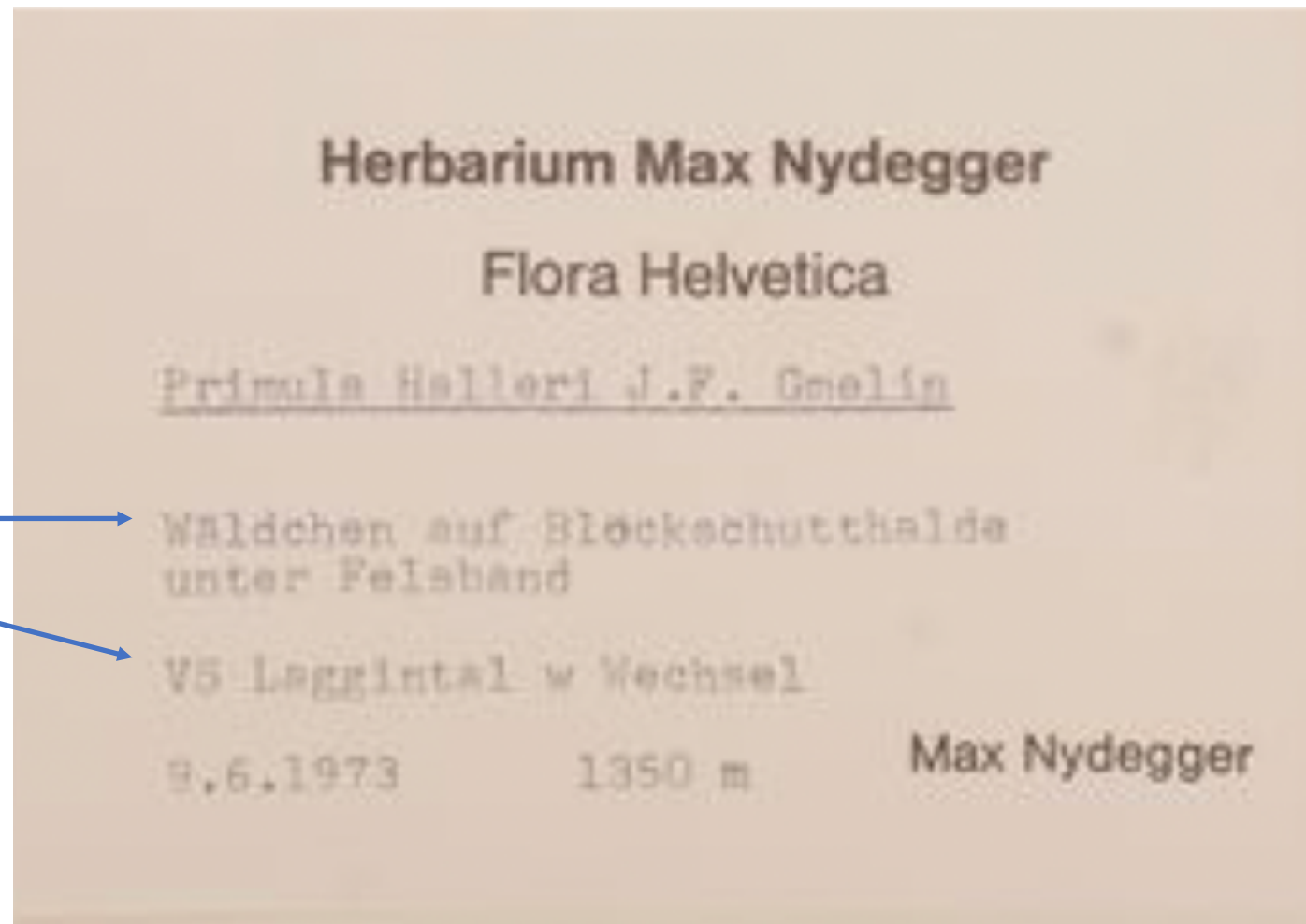


< 1970

Location::decimalLatitude: 46.17461
Location::decimalLongitude: 8.0727

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Location::locality: *neat description interpreted*
Location::decimalLatitude: **46.17461**
Location::decimalLongitude: **8.0727**
Location::minimumElevationInMeters: 1350
Location::maximumElevationInMeters: 1350

**All fields except «verbatim»-fields require some (straight-forward) interpretation.
DwC can capture both**



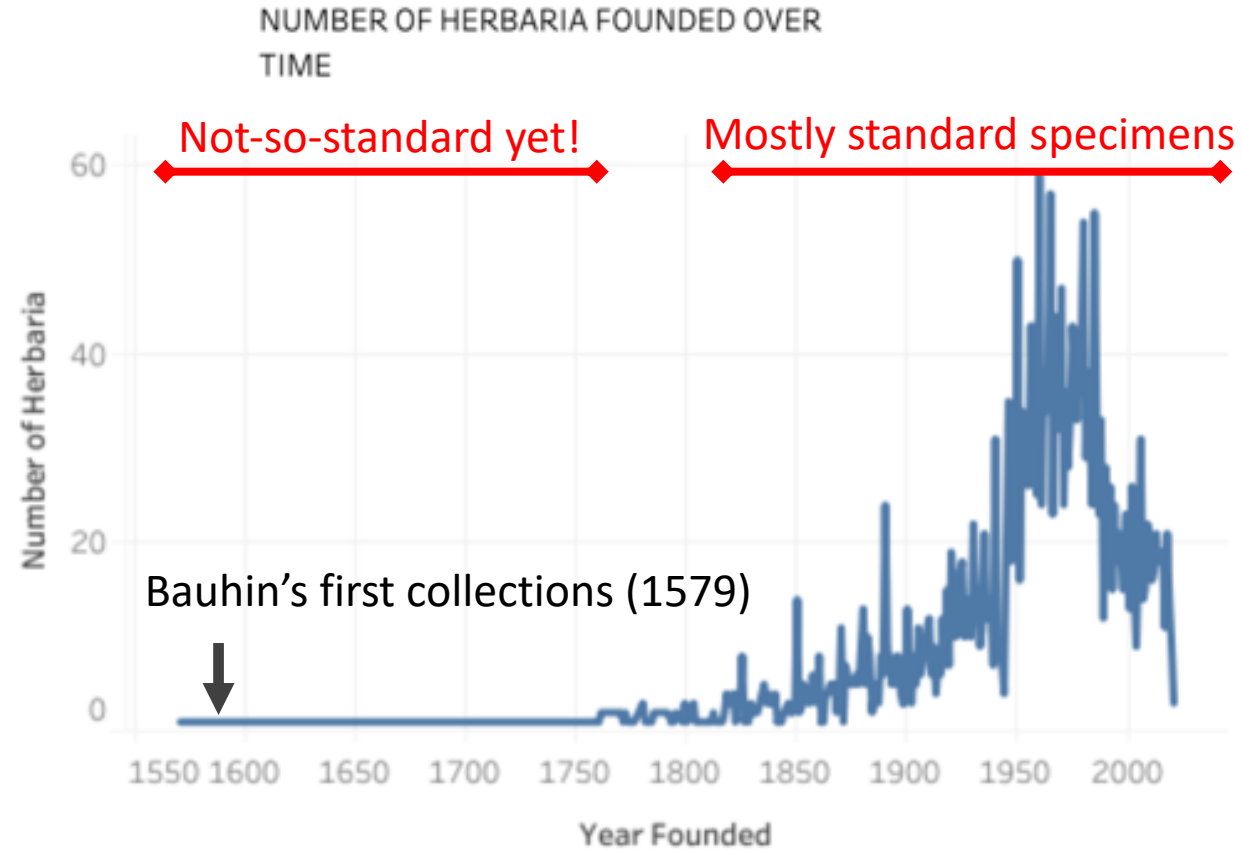
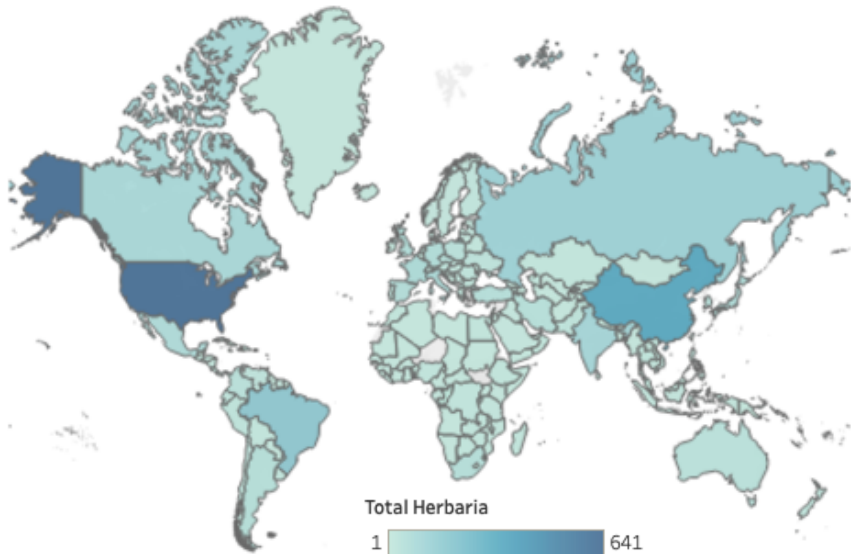
Classic collections: «Unstructured» elements

- No intrinsic association among elements, except filing system
- The scientific value of a specimen does not depend on the state of other specimens



Herbaria today

- 3522 herbaria
- 397 million specimens
- All known species (by definition)
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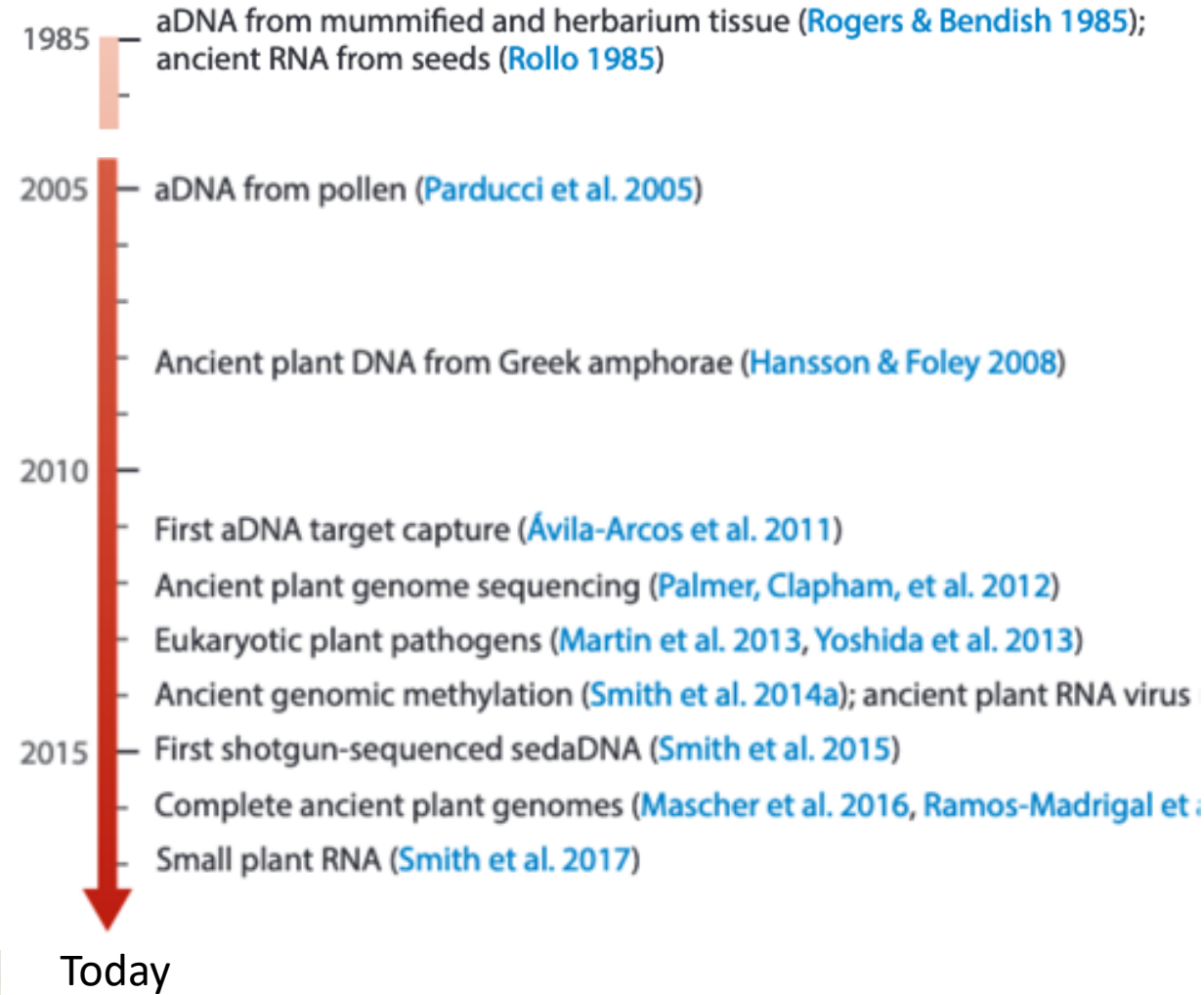


Data: Index Herbariorum annual report 2021





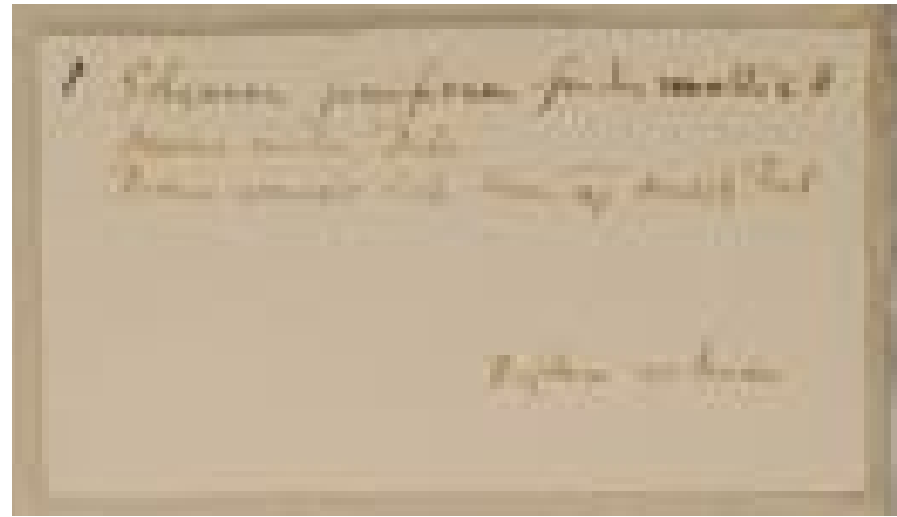
Plant aDNA timeline (Kistler et al. 2020)



Technological «jump»: critical to make earliest specimens discoverable!



How to interpret this specimen?



Provenance: Basel, garden of Caspar Bauhin
Collected: between 1589 (establishment of garden) and 1624 (death of Bauhin)

Record-level::type: physicalObject

Record-level::institutionCode: BAS

Record-level::basisOfRecord: PreservedSpecimen

Record-level::catalogNumber: 138

Occurrence::recordedBy: Caspar Bauhin

Event::eventDate: 1589/1624

Location::verbatimLocality: Basilea ex horto



What about this tomato plant??



3. Ein altes Herbarium aus den Jahren 1743 bis 1761.

Der Urheber dieser Sammlung konnte nicht festgestellt werden. Der wissenschaftliche Wert dieses Herbariums ist übrigens gering, da Fundortsangaben oft fehlen. Viele der darin enthaltenen Pflanzen sind auf Papier sorgfältig aufgeklebt, später wieder ausgeschnitten worden und mit wunderlichen, aus Kräuterbüchern entnommenen Namen versehen. Vermutlich sind diese Stücke aus einem noch ältern Herbarium hier eingereiht worden.

Binz, 1908, Die Herbarien der Botanischen Anstalt, Verh. Natf. Ges. Basel







What about this tomato plant??

Burgerbibliothek Bern

Campyloclelea fol. unguis.
Trachelium. Gronovius L.

82

Felix Platter (1536-1614) ???!

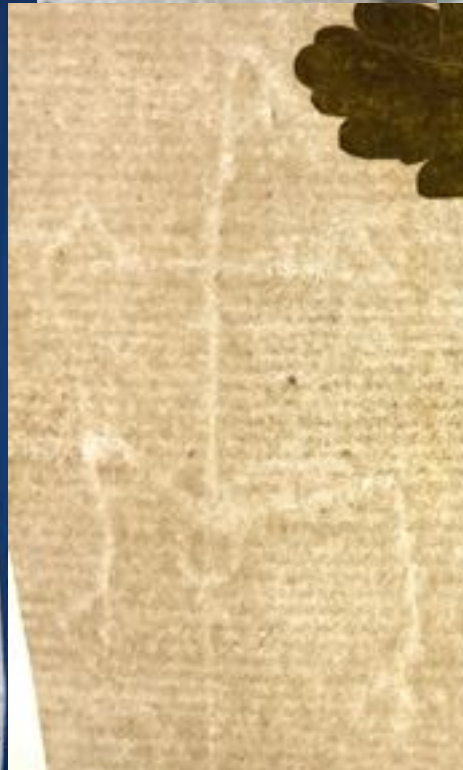






Bifolium

Bifolium
optivis
psuedorchis
caipna
Salysium
Zatigibak



Basel, 1730er
Paper mill «Heusler»



Watermarks of other sheets in collection



7. *Satureja pedunculis bifloris*, Linn. Sp. Plant. p. 568. Vir. Cliff.
 87. Hort. vps. 161. Mat. med. p. 284. Royen. Lugd. p. 324. Sauv.
 monsp. p. 142.
Satureja hortensis, C.B. Pin. p. 278. f. *Urtica sativa* Plin. Rwinga.
 --- *altara*. Cam. Epit. p. 487. p. 684.
Thymus erectus annuus, foliis lanceolatis linearibus. Linn. Hort.
 i. *Satureja sativa*. Boerh. i. p. 161. J. Bauh. h. Cliff. p. 306.
Satureja, Bodon. p. 276. Tourn. p. 197. 93.
 --- *domestica*, f. Syst. bot. 9. 12. f. 3. fig. 2.
Satureja, annua, curula dicta, vulgaris. M. K. 3. 411. a.
 = *Gammima* Dubnary.
 Ex herbaris vivo D. Stahelini Men. Lic. amici olim Mauri: auspici
 a. 1756.
 Hb. offic. est.



Satureja hortensis / foliis oppositis, ovatis
 et serratis, cuneatis, floribus capitato-
 umbellatis. Linn. Sp. Pl. p. 568. n. 7.
 C. foliis oppositis subulatis, ovatis, serratis.
 Hoffm. Cliff. p. 298. H. 1759. p. 306.
 Royen. Lugd. p. 324. p. 142.
 = *Satureja* sibirica Plin. p. 278.
 foliis ovatis, serratis, cuneatis, ciliatis.
 foliis lanceolatis linearibus, serratis.
 Plin. Hist. nat. p. 278. f. 3. Bauh.
 Pin. p. 278. n. 7.
 Ex herbario v. amicis. Cochet etc.
 D. Tijss. C. Bat. 1759.
 et ex herbario Stahelini Mauri: auspici.

Malva (caroliniana) caulis repens,
 foliis multifidis. Linn. Sp. Plant.
 p. 648. n. 7. Hort. Cliff. p. 247. Herb.
 vps. p. 142.
Abutilon repens, Alaba foliis, flava
 caliculis. Zinn. Ethn. d. T. 4. fig. 4.
Abutilon carolinianum repens, alaba
 foliis, gibbis floris. Martyni Centur. 74.
 T. 74.
 Ex herbario v. amicis. Cochet etc.
 D. Tijss. C. Bat. 1759.
 et ex herbario Stahelini Mauri: auspici.

L. Bat.: (Leiden)
 1759/1760
 Amici: (Friends)
 Locher
 Stockar
 Scheuchzer
 La Chenal

Ex herbario v. amicis. Cochet etc.
 D. Tijss. C. Bat. 1759.
 et ex herbario Stahelini Mauri: auspici.

- Jan
3. LAURENTIUS LUBLINK Kemper Amstelodamensis. 20, J.
6. JAN VAN ES Leydensis. 22, M. [M. Dr.
13. BALTHAZAR LAURENTIUS ZEIS Rauschenberga-Hassus. 30.
14. JOANNES LUDOVICUS DE BRUYN Harlemensis. 17, J.
" CAROLUS ZENYGRAF Soxo, Musicus. 24.
17. JONAS DU PONT Amstelodamensis. 19, M.
" GULIELMUS VAN LILL Rotterodamensis. 16, M.
18. YSRAND DE KOCK, CORN. filius, Rotterodamensis. 18, J.
20. PHILIBERTUS MORAND Burgundus. 44, M.
" FRANCISCUS BEELISNYDER Amstelodamensis. 18, J.
22. NICOLAUS THEODORUS DE LEEUW Amstelodamensis. 20, J.
" GERARDUS VAN HOGEVEEN Leydensis. 18, J. Hon. e.
24. WILLEM KORTMAN Leydensis, famulus studiosi BANIER. 18.
28. JOANNES HENRICUS TREYIN Indo-Batavus. 20, J.
" PETRUS ASD Sæcus. 24, P. Mag. et T. Cand.
- Feb.
2. RICHARDUS MERSER Dublino-Hibernus. 37, J.
4. PETRUS BACKER Medioburgo-Zelandus. Ann. ac. J.
11. HENRIK OTTO VAN OUDGAARDEN Rotterodamensis. 60,
M. et Chem. Cultor.
26. DAVID HARTLEY Anglus. 25, M. [50.
" GULIELMUS JENNER Helvetus, famulus studiosi HARTLEY.
- Apr.
2. WILHELMUS FADER Sasso-Gandavus. 20, M.
" JOANNES HADGER Rotterodamensis. 26, M.
8. JOANNES SCHEUCHZERUS Tigurinus. 49, M.
9. PETRUS GIBON Goudanus. 47, M.
13. JOANNES WILHELMUS JOHN Dantiscanus. 22, M.
" CONSTANTINUS ERNESTUS GEORGIUS Goudanus. 91, J.

- " ALBERTUS GUX Helvetus, famulus studiosi VERELST. 38.
23. CORNELIS SLINGERLAND Goudanus. 23, M.
26. JOHANNES LUDOVICUS DRYFHOUT Essena-Clivius. 32, M.
" GEORGIUS LOCHERUS Turicensis. 49, M.
29. JOANNES DANIEL VETTER Lesna-Polonus. 24, T. Coll. al. *
" GEORGIUS AUGUSTUS KÖRBER Hanoveranus. 22, M.

Oct.

ALBUM STUDIOSORUM

ACADEMIAE LUGDUNO BATAVAE

MDLXXV—MDCCLXXV

ACCEDUNT NOMINA CURATORUM ET PROFESSORUM

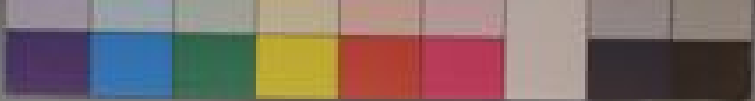
PER EADEM SECLA

HAGAE COMITUM
APUD MARTINUM NIDHOFF
MDCCLXXV

- Sept.
15. ADRIANUS VAN DER HOUT ex pago Maaslandsluys. 21, M.
" DAMIAAN JOHANNES VAN DOORNINCK Daventriensis. 19, J.
" HENRICUS GOORES Zutphaniensis, famulus studiosi CON-
VER HOOFT. 31. [Coll. al.
17. HENRICUS CAPPELHOFF ex pago Zuid-Zijp. Ann. ac. T.
" ALEXANDER DOUGLAS Scotus. 21, M. [19, J.
" JOHANNES DERK VAN DER WIECK Zwolla-Transisalanus.
" WILLEM ROELL, JANI filius, Ultrajectinus. 19, J. Hon. e.
" JACOB EVERWIJN Amstelodamensis. 20, T.
" PETRUS DE VAL Haga-Batavus. 18, M.
" JOHANNES HESHUSIUS Gelrus. 21, M.
18. JOHANNES ANTONIUS FRANQUINET Leodiensis. 18, J.
19. RODOLPH HENRICUS DE WETSTEIN Amstelodamensis. 18, P.
" NICOLAUS ADRIANUS VAN VELSE ex pago Raamsdonk. 18, T.
" JOHANNES PURCELL Hibernus. 19, M.
" JOHANNES CANISIUS Zelandus. 19, J.
20. JOHANNES VEIRAC Gouda-Batavus. 18, M. [ac. J.
22. JOHANNES HENRICUS MILET Middelburgo-Zelandus. Ann.
" JOHANNES LUDOVICUS BUXTORF Basileensis. 21, M. Hon. e.
21. CORNELIUS PETRUS HASSELAER Amstelodamensis. 18, J.
" MELCHIOR MEELINGER Moguntinus, famulus studiosi
" CORN. PETR. HASSELAER. 22.
- Nov.
22. ANDREA
- Dec.
14. JOHANNI
17. JOHANNI
31. SIBALDU
- Jan. 1760.
10. JOHANNI
- " LAUREN
- " JOHANNI
- Febr.
4. GEORGH
- Rectore**
9. BRUNO
11. GEORGH
- " JACOBUS
12. HENRICI
- " FRANCIS
18. REGNER
29. HENRICI
- " studio
- " JOANNES

Matrikel Univ. Leiden, 1759-1760

Johann Ludwig Buxtorf, Basel, 1738 – 1806
Revealed through collection context!



What about this tomato plant??

How to interpret this specimen?

Provenance: Basel

Collected: ca. 1730s.

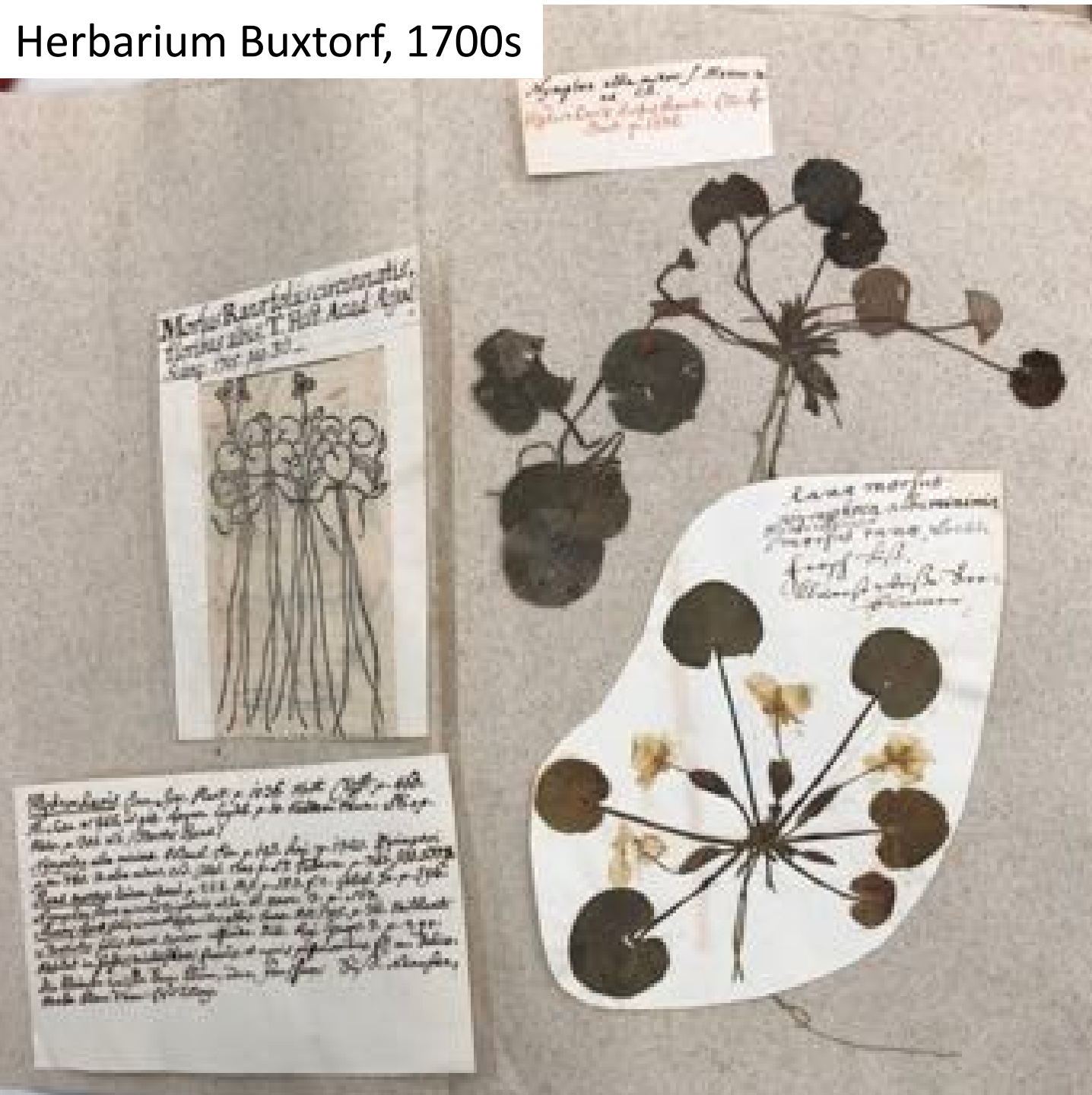
Collector: unknown

Event::eventDate: 1720/1750

NOT Platter (1536-1614)!!



Herbarium Buxtorf, 1700s



How to deal with this «specimen»?

Eeehhhhh....

Same species:

- Two loose plants
- One mounted plant
- One annotated drawing
- Two labels

Buxtorf's handwriting on «extensive» label matches:

- Corrections on other labels
- Name on folio

One «thing» containing other «things»

Taking a step back: Science of Archiving

- **Specimen:** a physical object that has been collected for scientific purposes, typically for the purpose of study or analysis.
 - «Herbarium specimens» are circumscribed by the Collectors intent, usually a *plant or representative parts*, plus *information* provided on a label or in a field book.

Taking a step back: Science of Archiving

- **Specimen:** a physical object that has been collected for scientific purposes, typically for the purpose of study or analysis.
 - «Herbarium specimens» are circumscribed by the Collectors intent, usually a *plant or representative parts*, plus *information* provided on a label or in a field book.
- **Object:** a physical item or material that is being preserved for historical, cultural, or scientific purposes.
 - «Herbarium objects» are circumscribed by the Curator. They consist of the herbarium specimen plus additional context materials relevant for the historical, cultural or scientific value of the specimen (paper materials, whether its a book, etc)
- Objects are more inclusive than specimens

What is and was the Collectors' intent?

- Modern intent of specimen: Document a **single occurrence** at one point in space and time
 - Labels contain information on the gathering event + unpreserved features.

What is and was the Collectors' intent?

- Modern intent of specimen: Document a **single occurrence** at one point in space and time
 - Labels contain information on the gathering event + unpreserved features.
- Historic intent: A «typological» representation of a **taxon**, on which you can see more details than on an illustration
 - Labels contain a lists of multiple known provenances, «specimens» contain multiple plants from different sources, for which a single label is provided
- Shift in concept: when within-species variation became a focus
 - Slowly from mid-1700s to 1800
- Consequences for specimen interpretation!

One «thing» representing information on one species:
- multiple labels, illustration, multiple plants!



One «thing» representing a single gathering in space and time



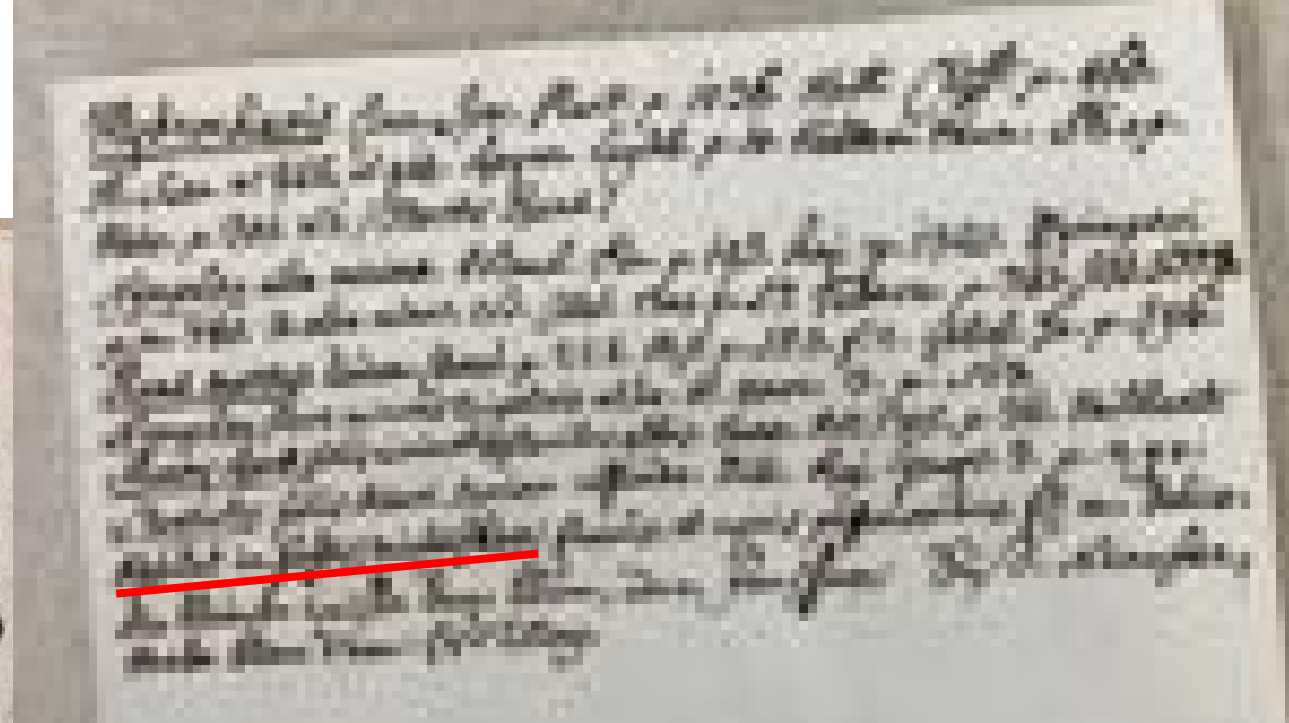
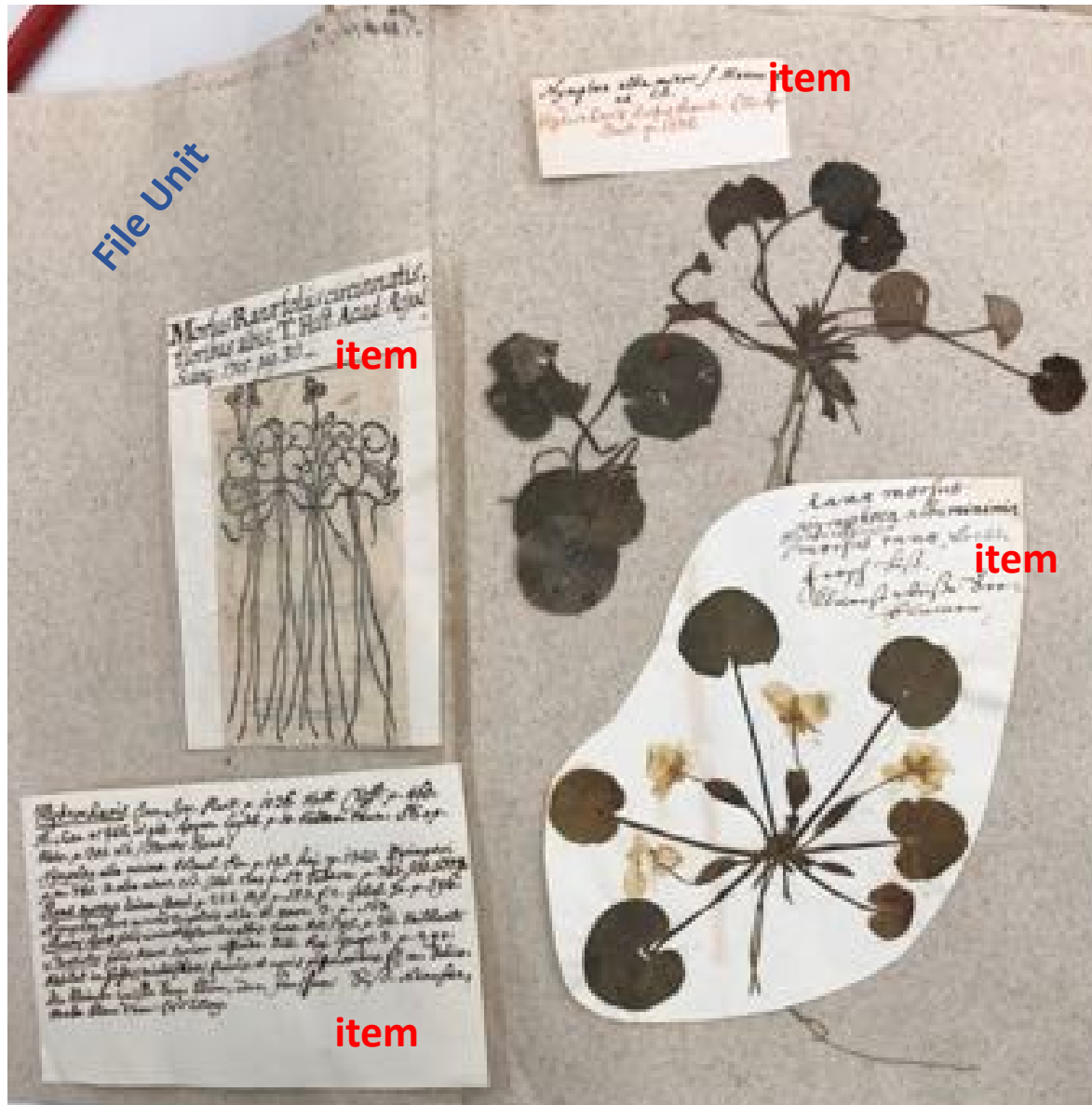
Taking a step back: Science of Archiving

- Standard: herbarium object == the herbarium specimen
- For historic specimens, this is very different!
 - Collectors intent is narrower than what the curator wants to preserve
 - E.g., corrections on particular labels; joint-storage.
 - Cultural-historic information
 - Context from which scientific information is deduced
- Historical «specimens» can be hierarchical

Taking a step back: Science of Archiving

- Archival records (objects) are described at various levels of aggregation (Society of American Archivists):
 - Record Group/Collection
 - Series
 - File Unit
 - Item
 - --> smallest intellectually indivisible item

One «thing» representing information on one species:
- multiple labels, illustration, multiple plants!



PhysicalObject, preservedSpecimen in the sense of DarwinCore:
Only the «standard» label, because it contains the occurrence
(*Habitat in fossis / Michelfeldae*)

Other items are physicalObjects, but not preservedSpecimens!
No existing DwC::BasisOfRecord class applies

Relations among items within file unit:
Parent-Child, where the »standard« label is parent, because it

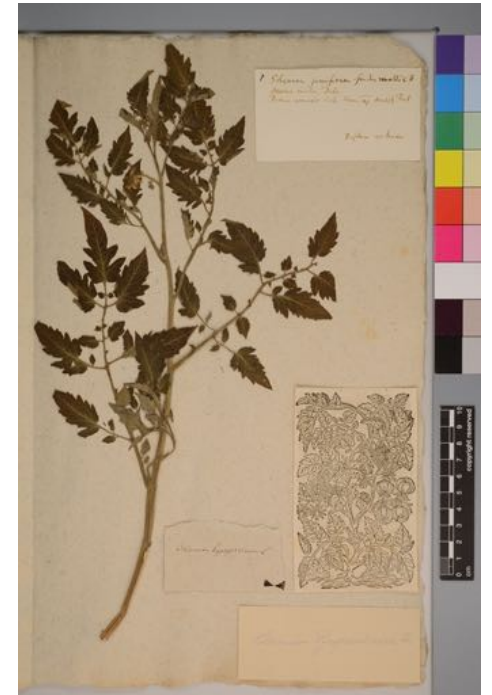
Remember

- Specimens, because of collectors intent
- Objects to preserve, because of curators intent
- Historic specimens require careful interpretation in their context
 - The context needs to be preserved, too!
 - Not every item that is preserved and catalogued is a preservedSpecimen

- All of this is «thoughts in process»!

Data standards in practise:

Digitizing “difficult” 16th-18th century herbaria



Jurriaan M. de Vos

Principal Curator Herbaria Basel, University of Basel

SwissCollNet Workshop 20. Jan. 2023