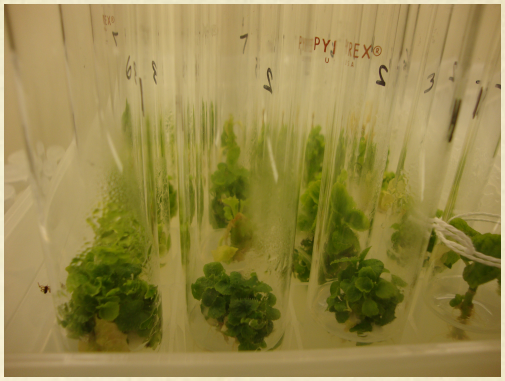
Lyon Arboretum Seed Conservation Laboratory:

Storage Characteristics of Native Hawaiian Seeds

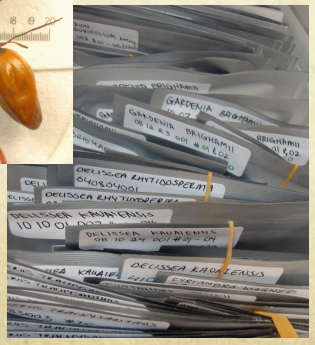
Research by Alvin Yoshinaga
Presented by Timothy Kroessig

Hawaiian Rare Plant Program at Lyon Arboretum

Rare Plant Greenhouse



Seed Laboratory



Micropropagation Laboratory

LYON ARBORETUM

Contributors

- Plant Extinction Prevention Program (PEPP)
- US Fish and Wildlife Service
- Department of Forestry and Wildlife
- Department of Land and Natural Resources
- Other organizations & individuals

Seed Conservation Laboratory

- Storage research of Hawaiian seeds started in 1995 by Alvin Yoshinaga (CCRT)
- Common native Hawaiian species for storage research
  - Classification of species according to storability
    - Orthodox, Intermediate, or Recalcitrant
  - Determine optimal storage conditions
  - Find best method for germination
- Rare, Threatened, or Endangered native Hawaiian plants for long term storage

Seed and Fruit Material

Inventory at a Glance

- ~450 different species
  - Of which ~200 have federal status
- ~1,750 accessions
  - ~5,000 seed lots
- Currently storing more than 3 million seeds

Optimal Storage Conditions

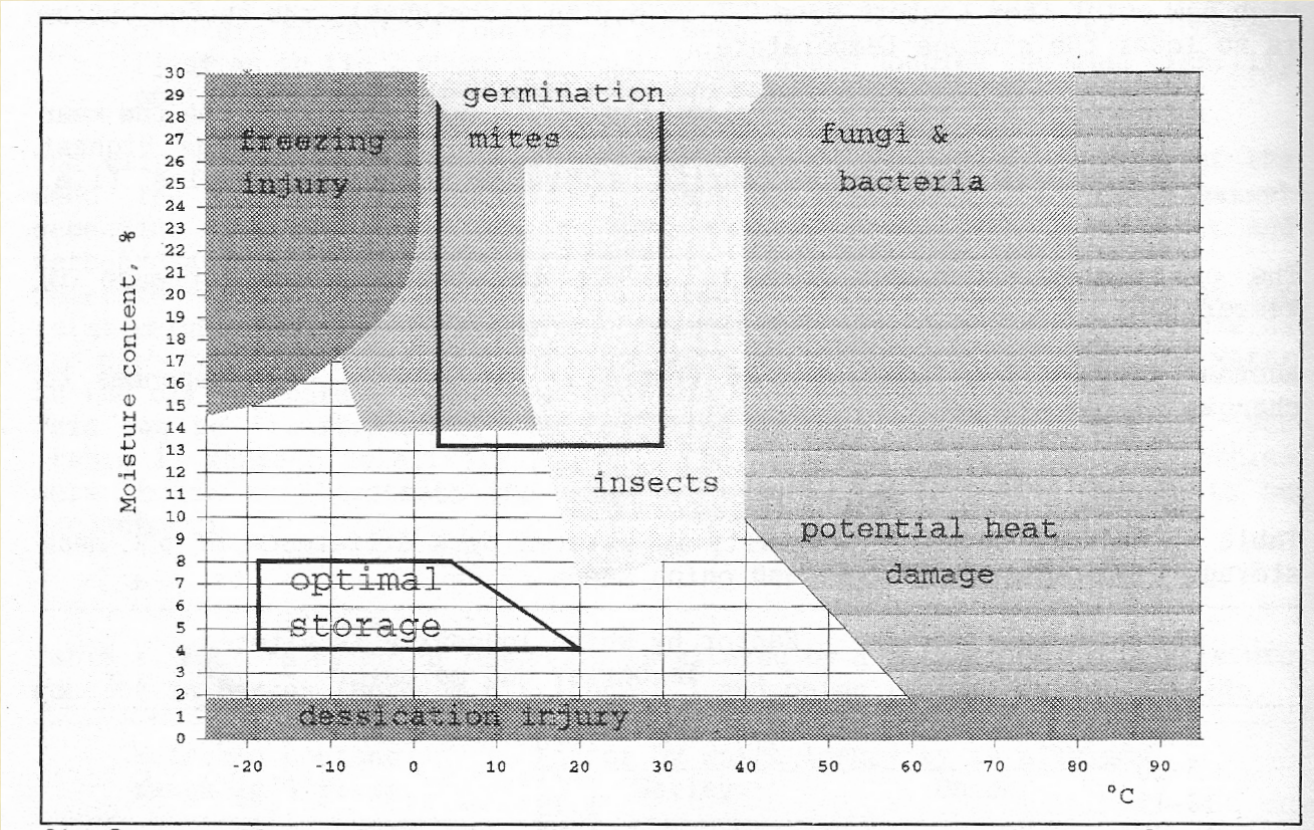


fig 3. The relationship between seed moisture content and storage problems at different temperatures.

(Ellis and Roberts, 1980)

Walters, 2004

TABLE A2.3

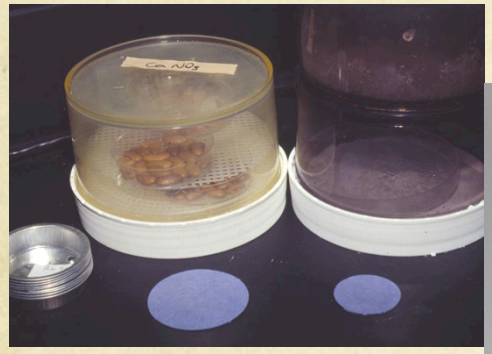
Recommended drying conditions for seeds stored in moisture-proof containers at various temperatures. The given drying temperature and RH combinations give a storage RH of 20% at the indicated storage temperature.

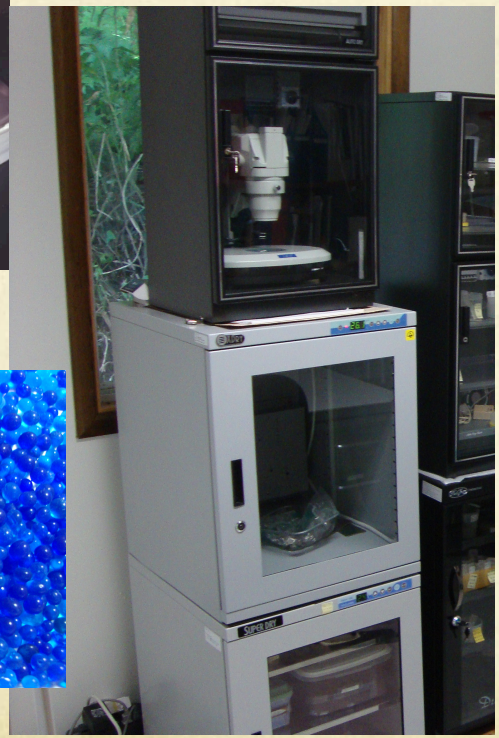
Drying Temperature (°C)	Drying RH for Storage at 15°C	Drying RH for Storage at 5°C	Drying RH for Storage at −18°C
25	28	33	46
15	20	26	38
5	14[a]	20	32

[a]Drying seeds at temperatures less than the storage temperature is not cost-effective and therefore strongly discouraged: dehumidification is more difficult at lower temperatures, and the refrigeration costs used during drying might be more effectively spent during storage.

Achieving Proper Seed Storage Conditions

Moisture content

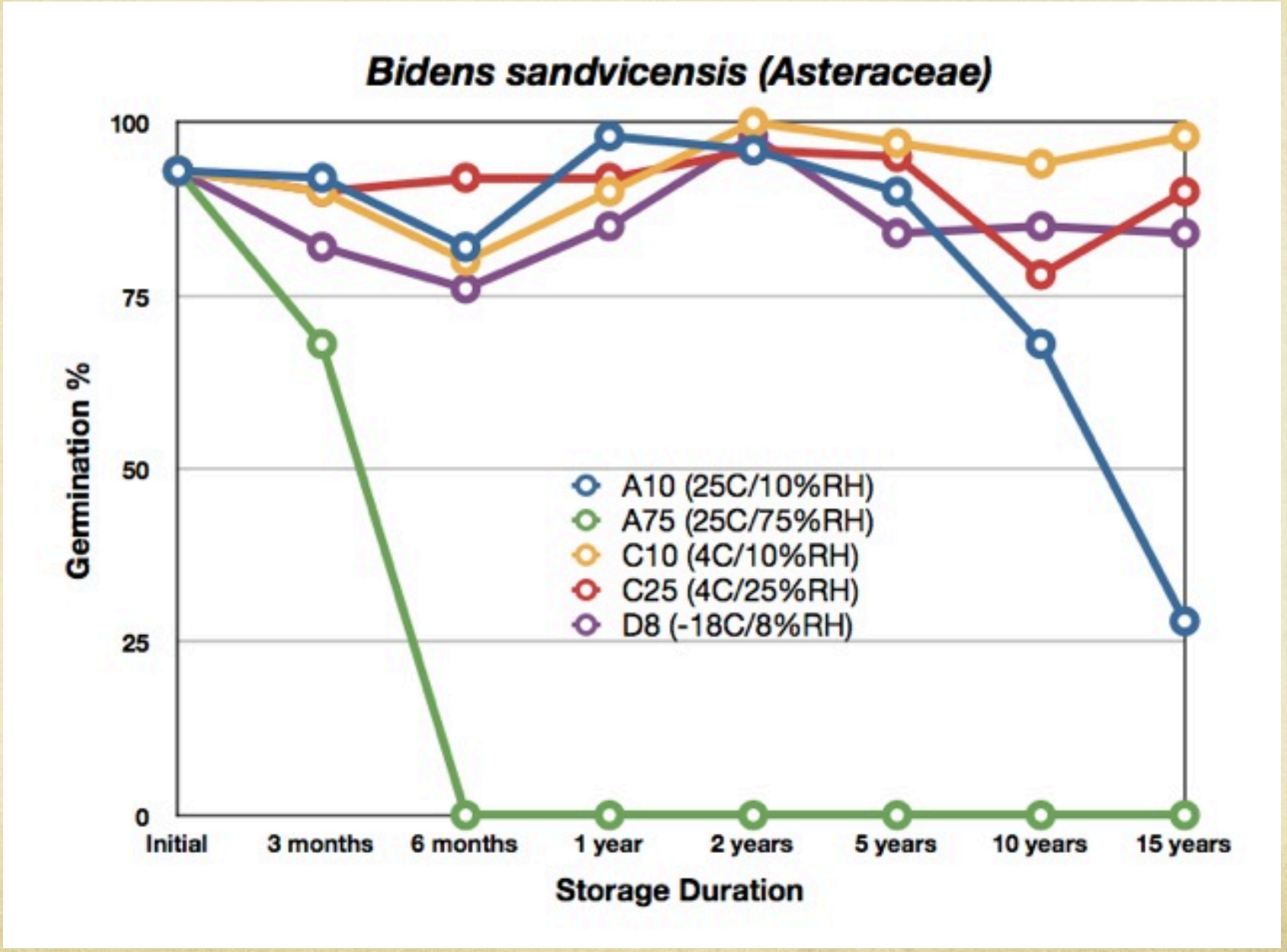


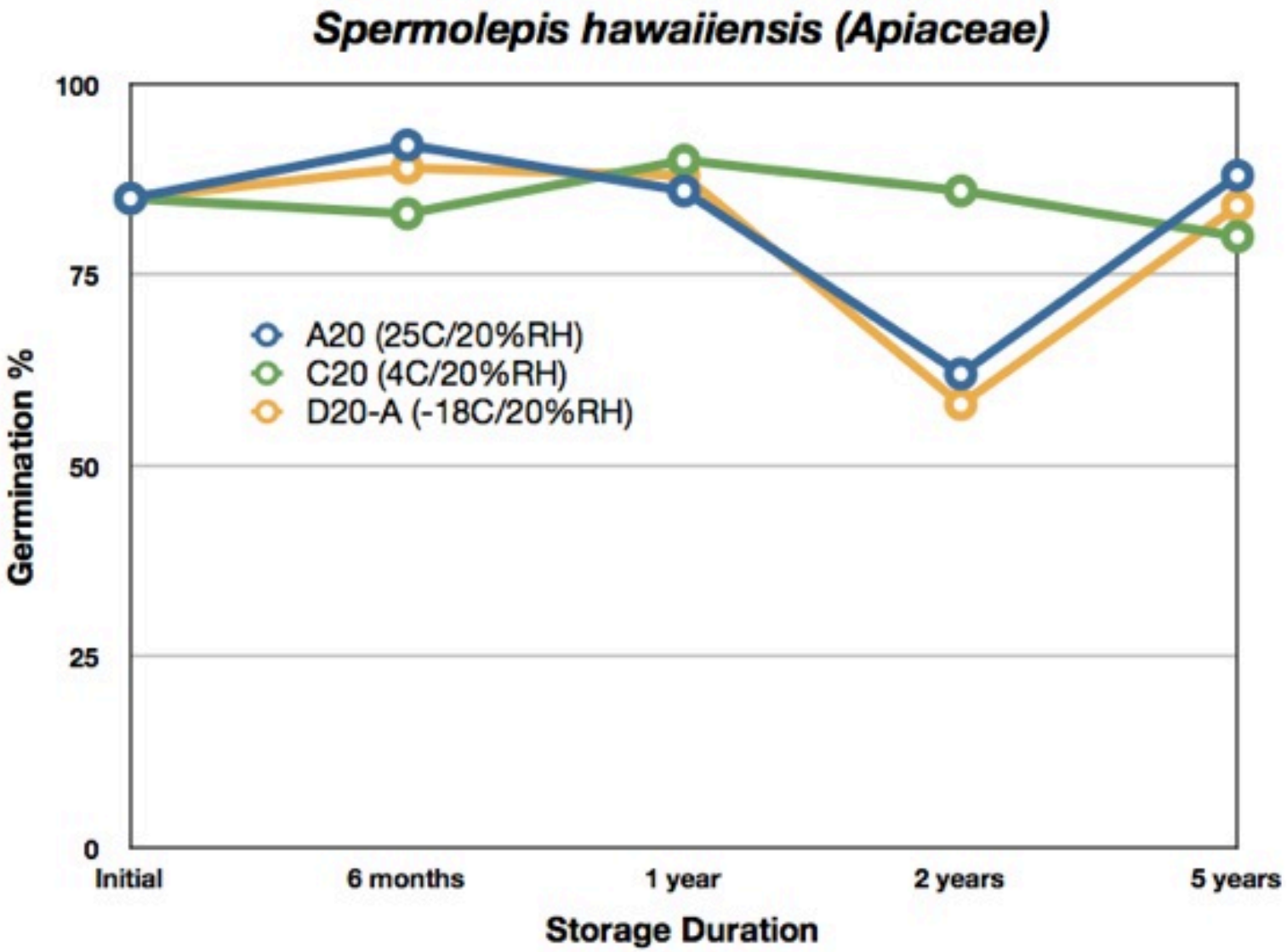


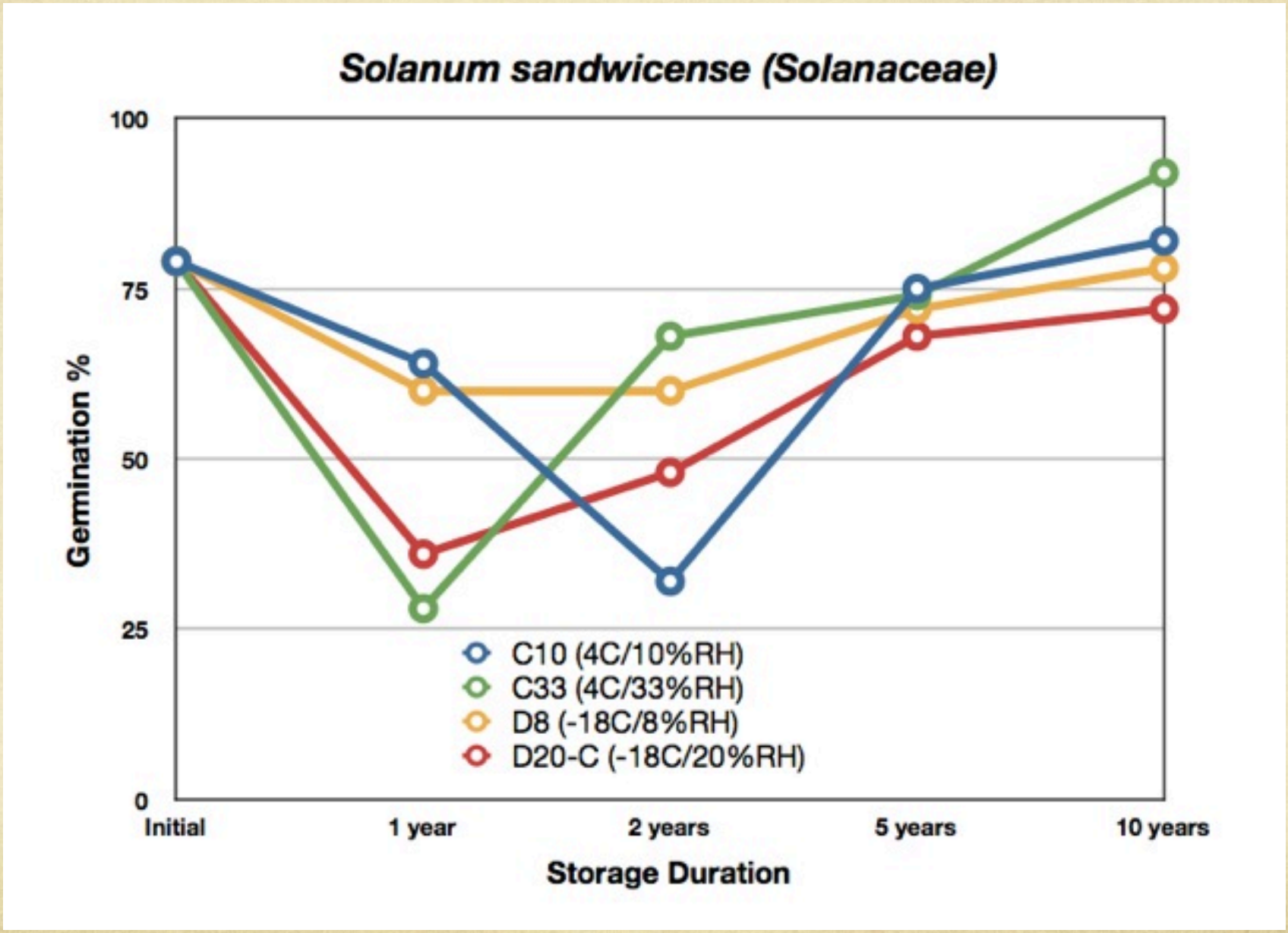
Temperature

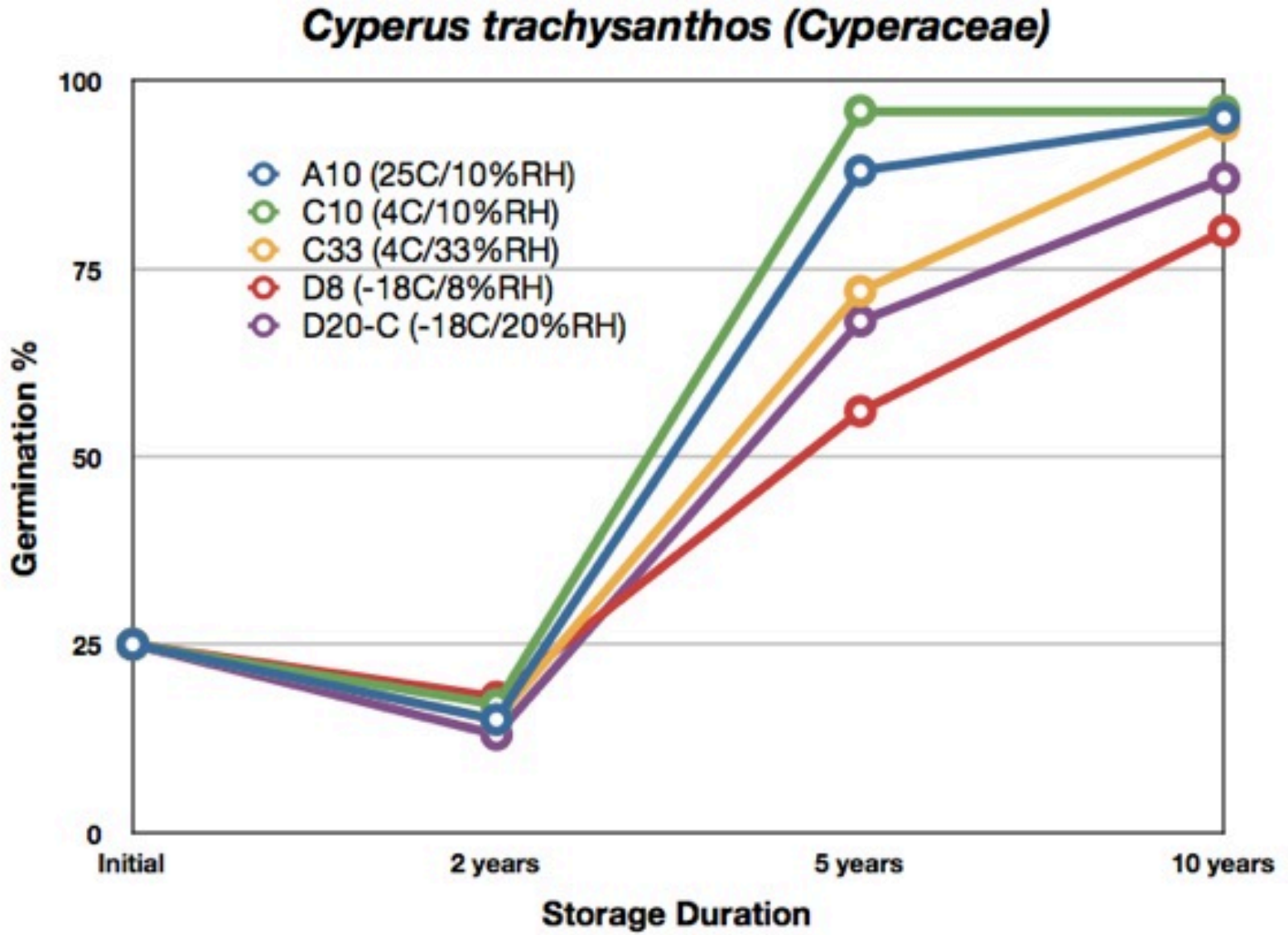
Data Interpretation

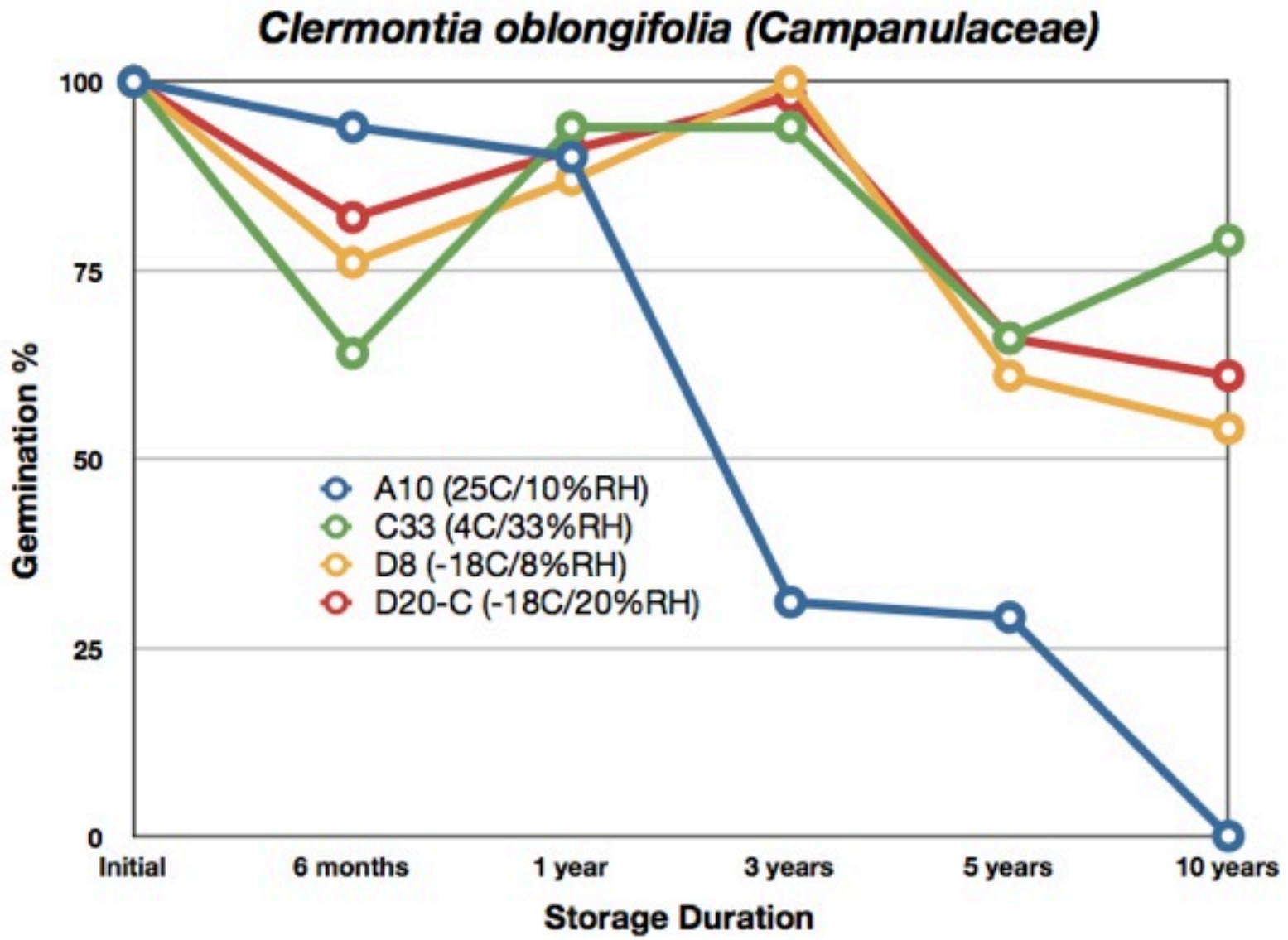
- Data shown in graphs is not an exact representation of seed lot viability, but can be used to speculate about storage trends
- Number of seeds sown in each test and testing intervals are not consistent
- Number of seeds sown in each test is not sufficient to statistically rule out seed batch margin of error
- Storage codes:
  - Letter represents Temperature (A= 25C, C= 4C, D= -18 C)
  - Numbers represent storage relative humidity (not moisture content of seed)

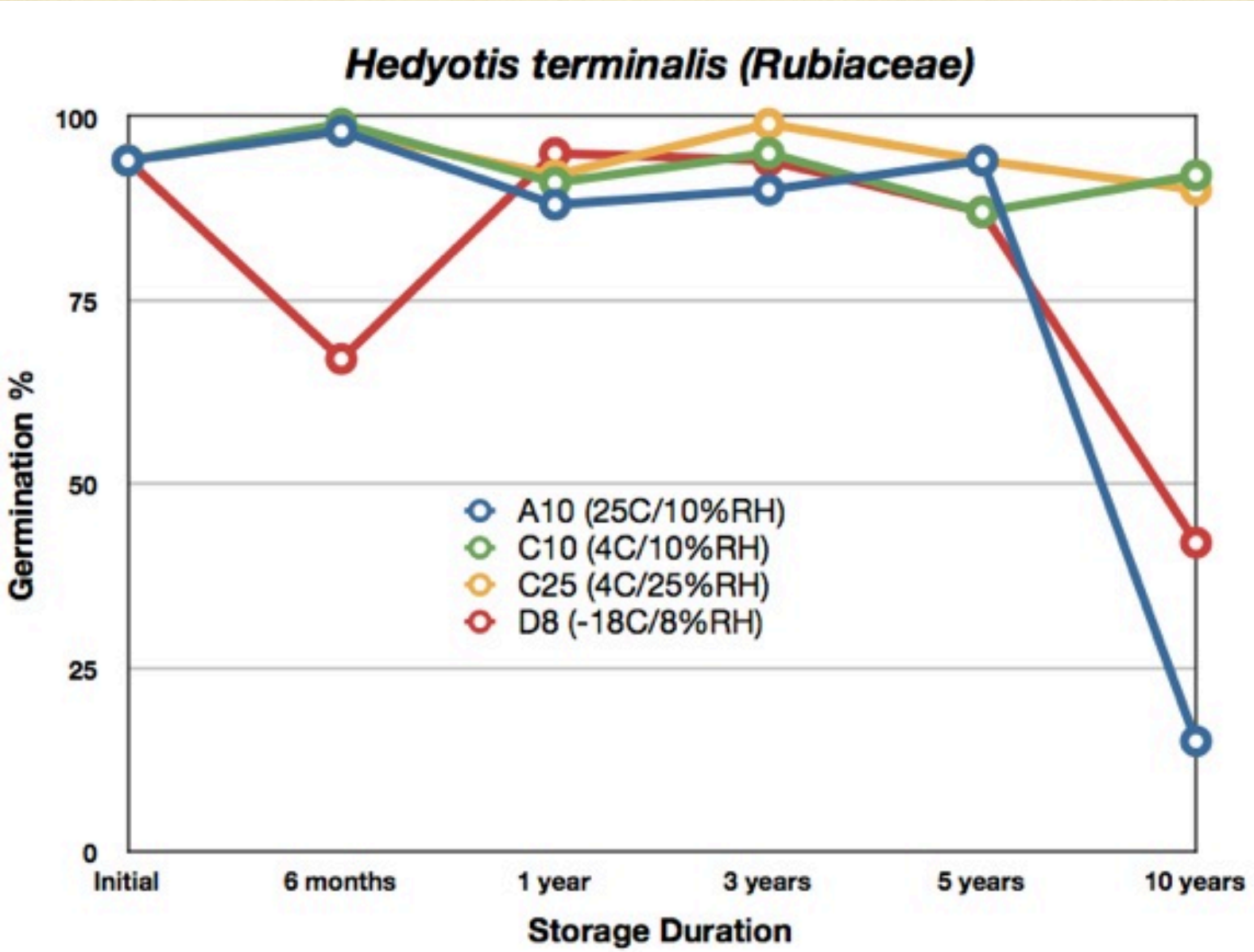

Bidens sandvicensis (Asteraceae)
100
75
50
25
0
Germination %
A10 (25C/10%RH)
A75 (25C/75%RH)
C10 (4C/10%RH)
C25 (4C/25%RH)
D8 (-18C/8%RH)
Initial
3 months
6 months
1 year
2 years
5 years
10 years
15 years
Storage Duration

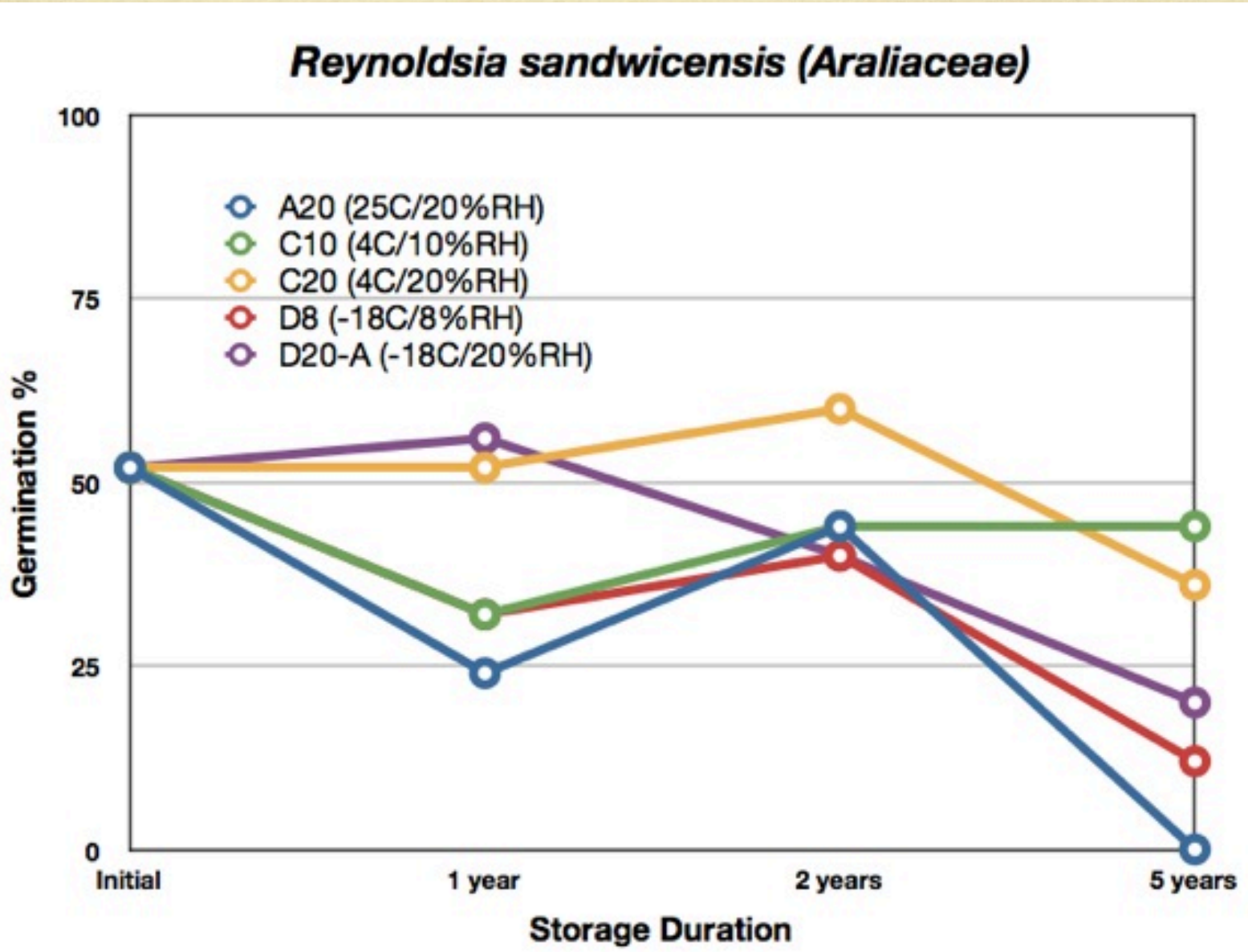

Spermolepis hawaiiensis (Apiaceae)
100
75
50
25
0
Germination %
A20 (25C/20%RH)
C20 (4C/20%RH)
D20-A (-18C/20%RH)
Initial
6 months
1 year
2 years
5 years
Storage Duration

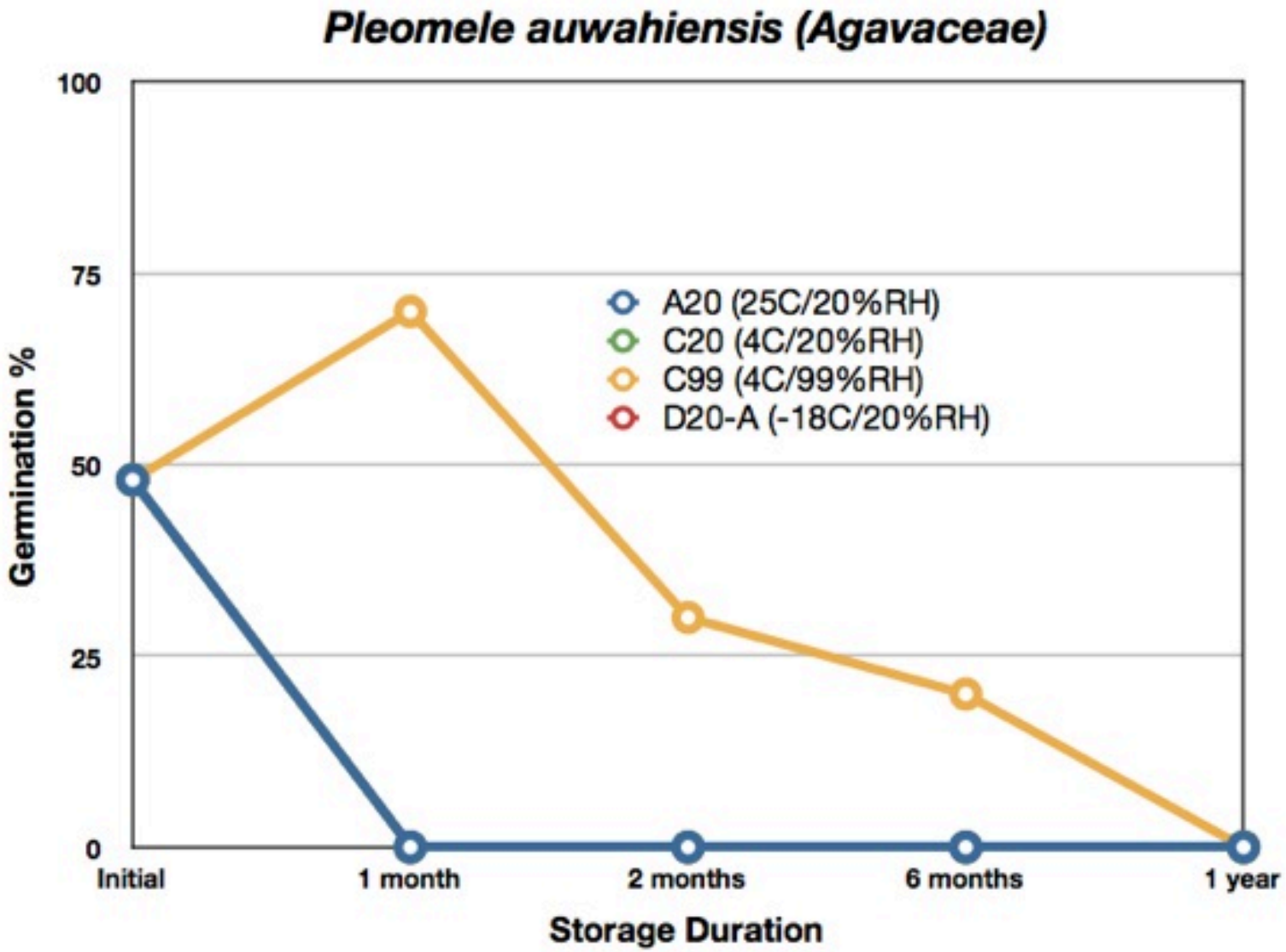

Solanum sandwicense (Solanaceae)
100
75
50
25
0
Germination %
C10 (4C/10%RH)
C33 (4C/33%RH)
D8 (-18C/8%RH)
D20-C (-18C/20%RH)
Initial
1 year
2 years
5 years
10 years
Storage Duration


Cyperus trachysanthos (Cyperaceae)
100
75
50
25
0
Germination %
A10 (25C/10%RH)
C10 (4C/10%RH)
C33 (4C/33%RH)
D8 (-18C/8%RH)
D20-C (-18C/20%RH)
Initial
2 years
5 years
10 years
Storage Duration


Clermontia oblongifolia (Campanulaceae)
100
75
50
25
0
Germination %
A10 (25C/10%RH)
C33 (4C/33%RH)
D8 (-18C/8%RH)
D20-C (-18C/20%RH)
Initial
6 months
1 year
3 years
5 years
10 years
Storage Duration


Hedyotis terminalis (Rubiaceae)
100
75
50
25
0
Germination %
A10 (25C/10%RH)
C10 (4C/10%RH)
C25 (4C/25%RH)
D8 (-18C/8%RH)
Initial
6 months
1 year
3 years
5 years
10 years
Storage Duration


Reynoldsia sandwicensis (Araliaceae)
100
75
50
25
0
Germination %
A20 (25C/20%RH)
C10 (4C/10%RH)
C20 (4C/20%RH)
D8 (-18C/8%RH)
D20-A (-18C/20%RH)
Initial
1 year
2 years
5 years
Storage Duration


Pleomele auwahiensis (Agavaceae)
100
75
50
25
0
Germination %
A20 (25C/20%RH)
C20 (4C/20%RH)
C99 (4C/99%RH)
D20-A (-18C/20%RH)
Initial
1 month
2 months
6 months
1 year
Storage Duration

Turning Science into Practice

- Studies of seeds of Hawaiian native plants show a very low incidence of recalcitrance
- Of the 207 taxa screened so far, 74.7% are clearly not recalcitrant, and an additional 19.9% are probably not recalcitrant
- The requirement for long distance dispersal selects against establishment of species with recalcitrant seeds
- Seeds of many oceanic island species can be stored using conventional techniques for orthodox seeds

Yoshinaga & Walters, 2003

Improving Methods for Future Seed Storage Research

- Collection of larger seed lots
- Multiple collections from different populations and islands
- Consistent testing intervals (6 months, 1 year, 2 years, 5 years, 10 years)
- Consistent storage regimes (A20, C20, D20-A)
- Mechanisms of morphological and physiological dormancies

Special Thanks to:

- Alvin Yoshinaga (research and seed photos)
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- Workshop coordinators
- You! For being here.

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