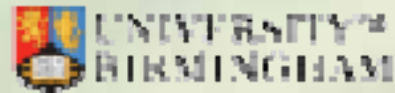


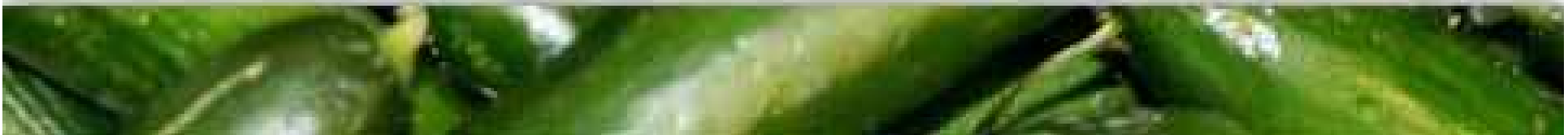
# The Characterisation of Heritage Vegetables

Jennifer Preston, Nigel Maxted, Bob Sherman, Neil Munro and Brian Ford-Lloyd



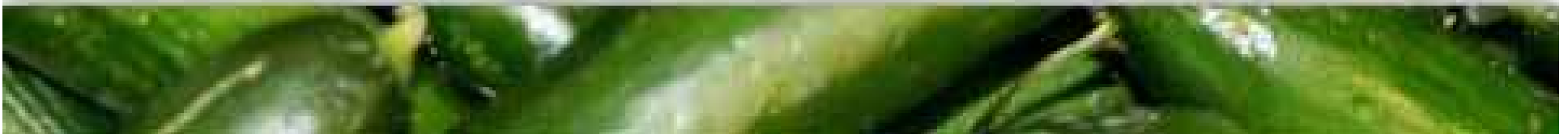
# Overview

- Introduction to Garden Organic
- Project aims and objectives
- Morphological characterisation
- Future work



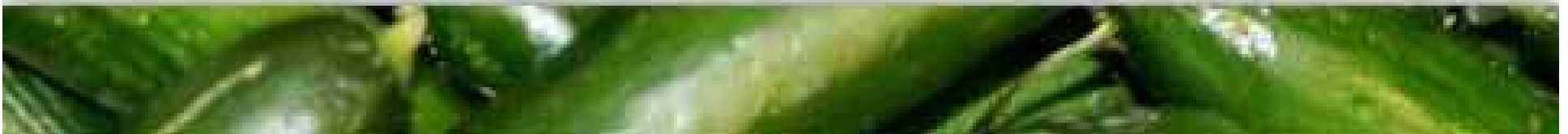
# Garden Organic - History

- Henry Doubleday Research Association (HDRA)
- Started by Lawrence Hills (1954)
- Charitable status (1958)
- Membership organisation for experimental gardeners
- Expansion
  - Alan and Jackie Gear (1974)
  - Move to Ryton (1984)



# Garden Organic - Today

- 30,000 members
- Organic gardening advice and promotion
- Display gardens at Ryton, Warwickshire
- Scientific research
- Current projects include schools, home composting and One Pot Pledge
- Heritage Seed Library



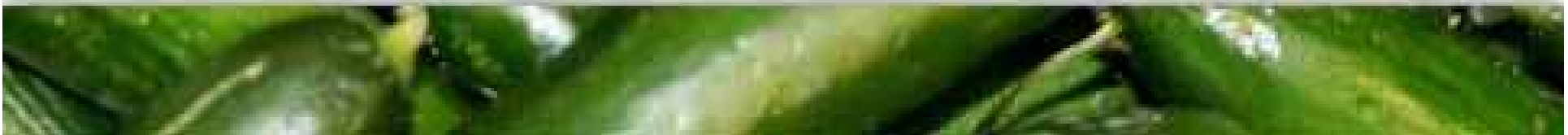
# Garden Organic - Heritage Seed Library

- Started 1975 in response to Seed (National List of Varieties) Act, 1973
- 800 accessions, 30 species
- Aim: to conserve heritage vegetable varieties and make them available to growers



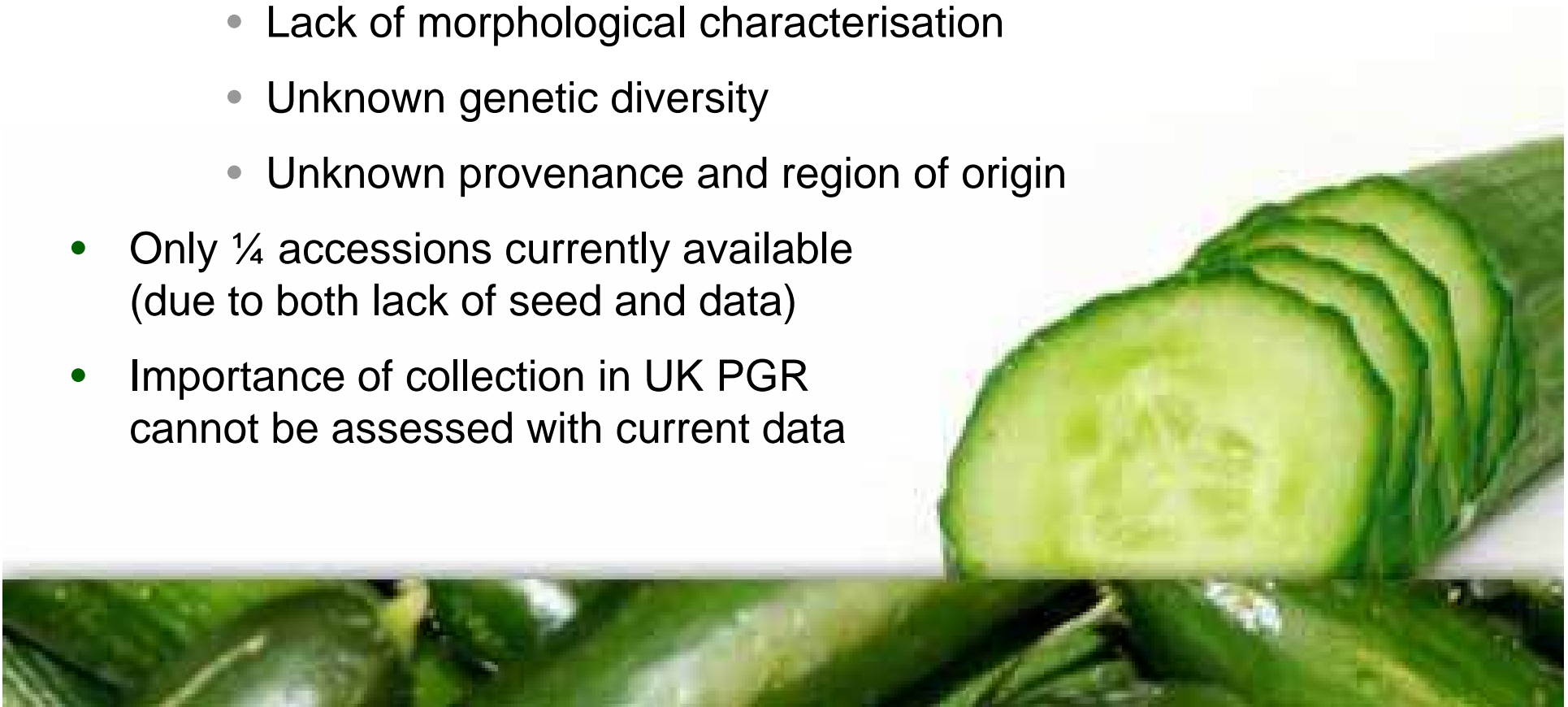
# What are heritage varieties?

- Collection generally referred to as heritage vegetables
- Includes ex-catalogue varieties (including some landraces) and heirlooms
- Consider a spectrum from landraces to modern varieties (Scholten *et al.*, 2009)
- Where an accession sits can depend on:
  - Initial genetic diversity
  - Bottle necks
  - Length of cultivation period
  - Environmental conditions



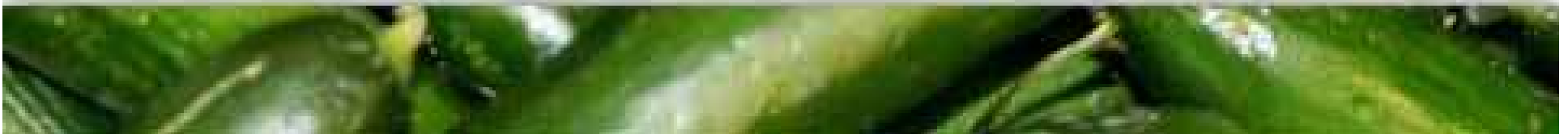
# Garden Organic - Heritage Seed Library

- Where do accessions sit in the spectrum?
  - Incomplete data:
    - Name only
    - Lack of morphological characterisation
    - Unknown genetic diversity
    - Unknown provenance and region of origin
- Only  $\frac{1}{4}$  accessions currently available (due to both lack of seed and data)
- Importance of collection in UK PGR cannot be assessed with current data



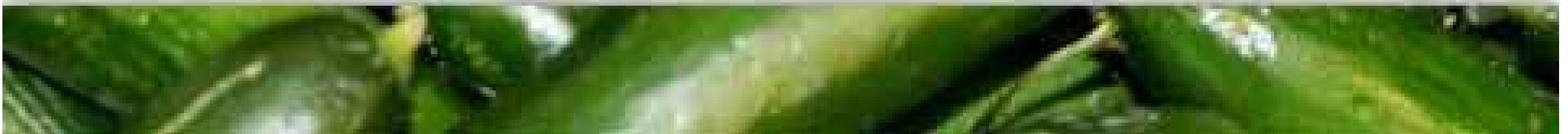
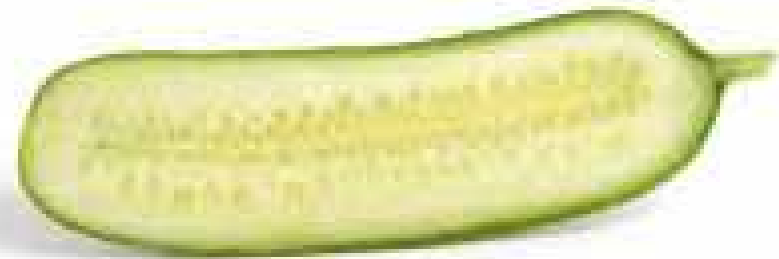
# Garden Organic - Heritage Seed Library

- Research problem
- Lillian Goldman Trust
- Project aim: to characterise the Heritage Seed Library
- Project areas:
  - Morphology
  - Molecular markers
  - Questionnaires



## Research questions

- What genetic diversity does the collection contain (within and between accessions)?
- How does the genetic diversity of the HSL collection compare to those commercially available?
- Are morphological and genetic diversity found in the same crops?
- Are there any duplicate accessions in the collection?



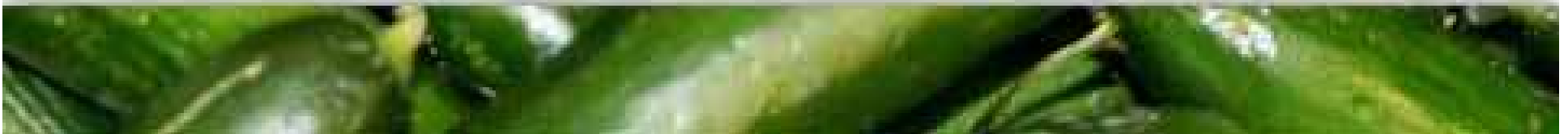
# Morphological methods

- Field trials
  - Experimental design: randomised and complete blocks
  - 3 replicates of 5 plants
  - 2 standard varieties per crop
- Morphological descriptors
  - Bioversity (formerly IPGRI)
  - HSL



# Morphological methods

- *Vicia faba*
- *Phaseolus vulgaris*
- *Allium porrum*
- *Allium cepa*
- *Capsicum annuum*
- *Solanum lycopersicon*
- *Daucus carota*
- *Cucumis sativum*
- *Lactuca sativa*
- *Pisum sativum*
- *Rhaphanus sativa*
- *Brassica napus napobrassica*



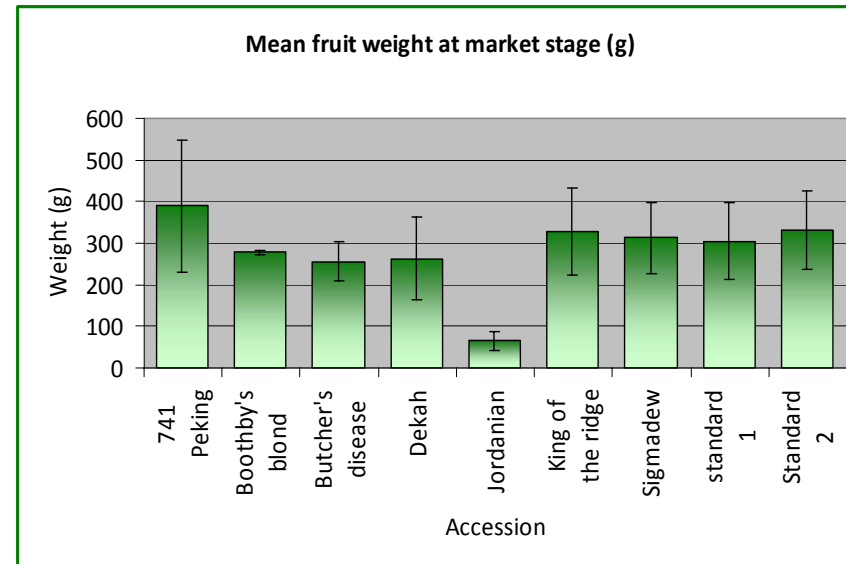
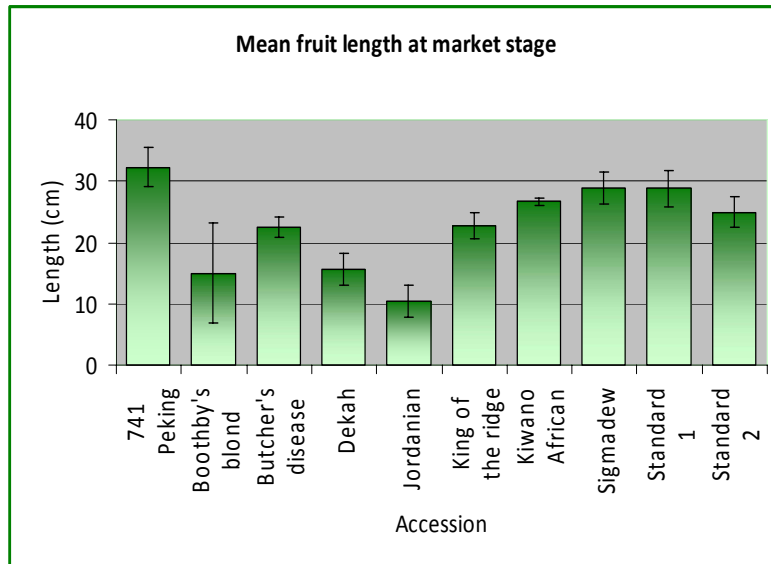
# Morphological results - *Cucumis sativum*

- 13 accessions
- 20 characters recorded

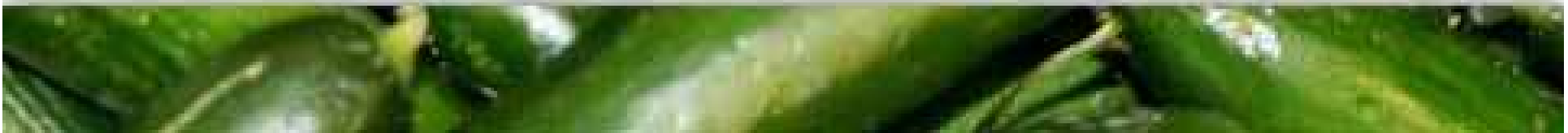
Descriptor
Internode length (cm)
Leaf blade length (cm)
Leaf blade width (cm)
Leaf hairiness
Fruit length (cm)
Fruit width (cm)
Fruit weight (g)
Fruit shape at stem end
Fruit shape at blossom end
Fruit spines
Fruit stripe colour
Skin colour (market/ripe)
Skin dull/glossy
Skin texture
Spine colour
Fruit mottling



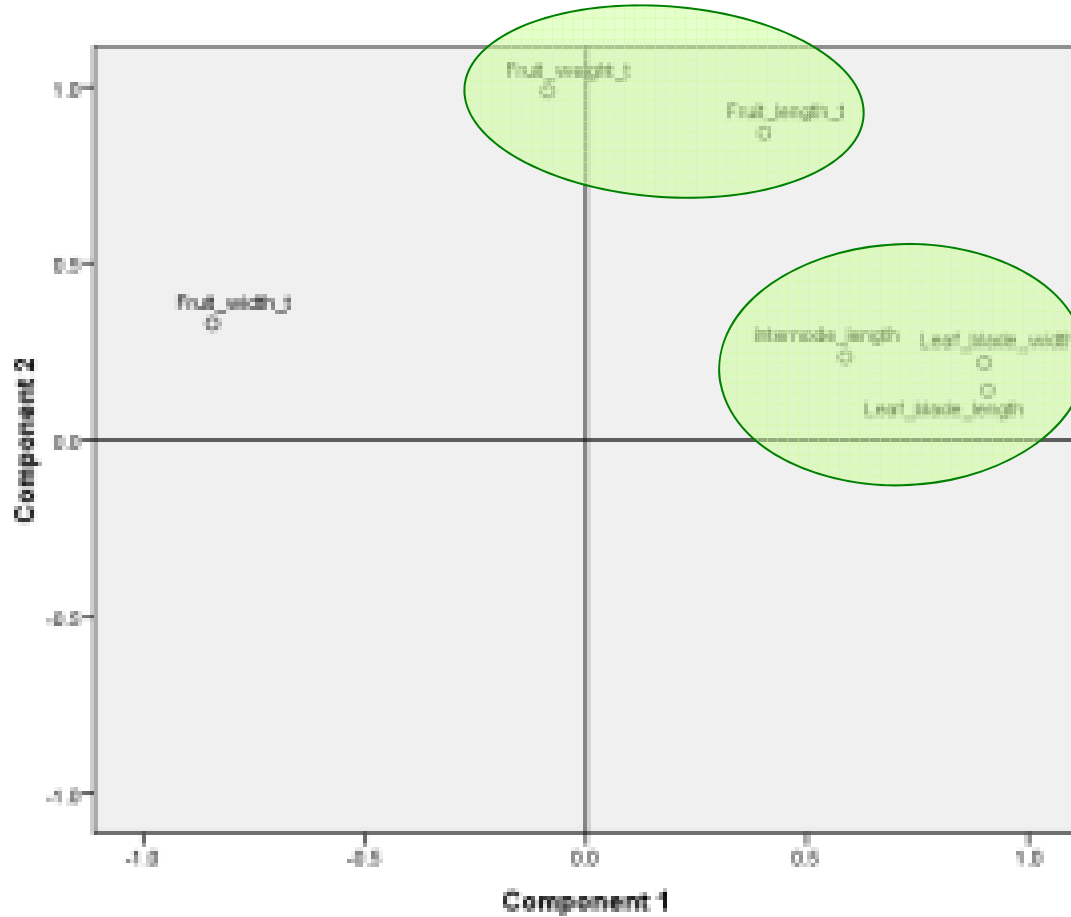
# Morphological results - *Cucumis sativum*



Morphological diversity high - variation found within and between accessions

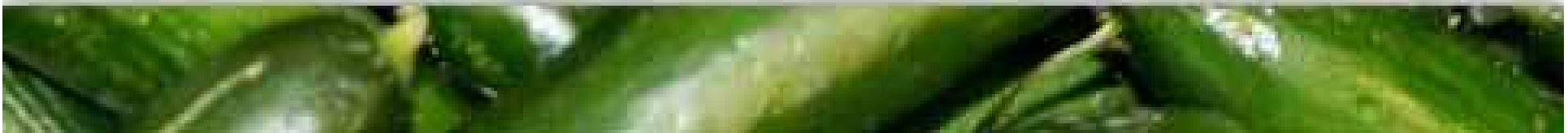


# Cucumis sativum PCA



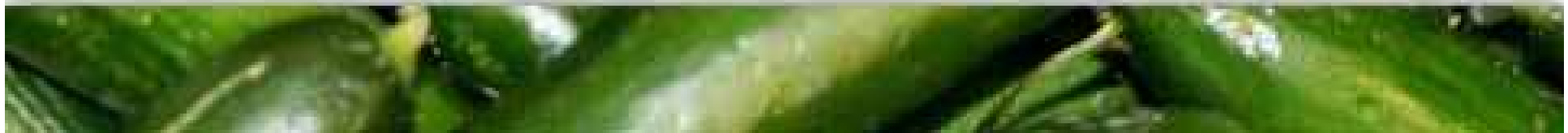
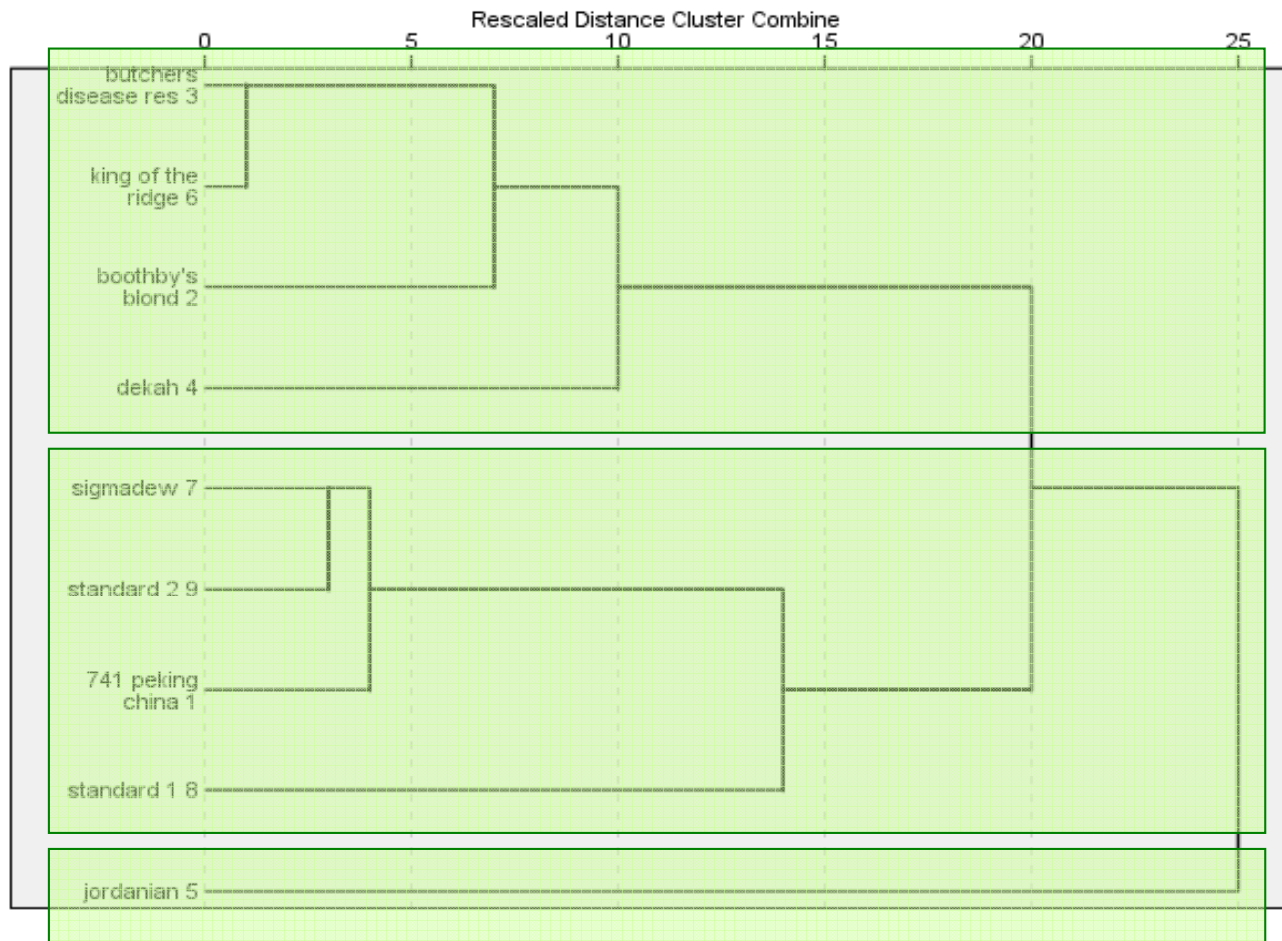
	Initial Eigenvalues		
	Total	% Variance	Cumulative %
1	3.047	50.782	50.782
2	1.773	29.542	80.325
3	.801	13.356	93.680
4	.324	5.396	99.076
5	.034	.573	99.649
6	.021	.351	100.00

	Component	
	1	2
Leaf Blade Width	<b>.899</b>	.221
Leaf Blade Length	<b>.907</b>	.143
Internode Length	<b>.585</b>	.237
Fruit Length	.404	<b>.869</b>
Fruit Width	-.843	.329
Fruit Weight	-.086	<b>.988</b>



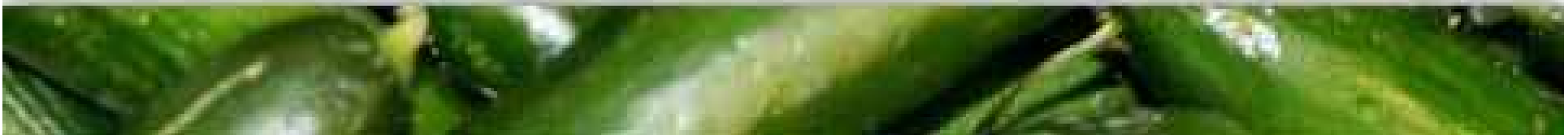
# *Cucumis sativum* cluster analysis (UPGMA)

Dendrogram using Average Linkage (Between Groups)



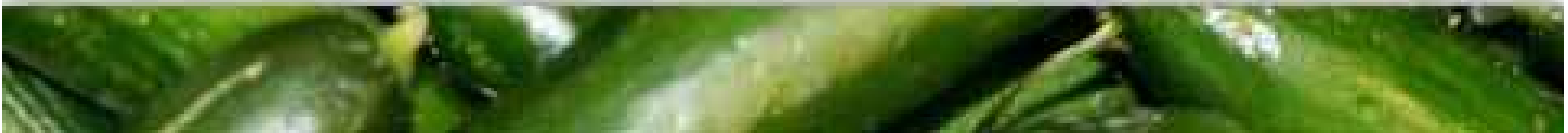
## Future work - Molecular markers

- Amplified Fragment length Polymorphism (AFLP)
  - DNA fingerprinting
  - Processed at IBERS
  - Measuring genetic diversity
  - Seven crops; 200 accessions; two primer pairs per crop.
  - 150-200 scorable characters
- Crop species
  - *Daucus carota*
  - *Pisum sativum*
  - *Vicia faba*
  - *Cucumis sativum*
  - *Brassica oleracea* var. *acephala*
  - *Lactuca sativa*
  - *Phaseolus coccineus*



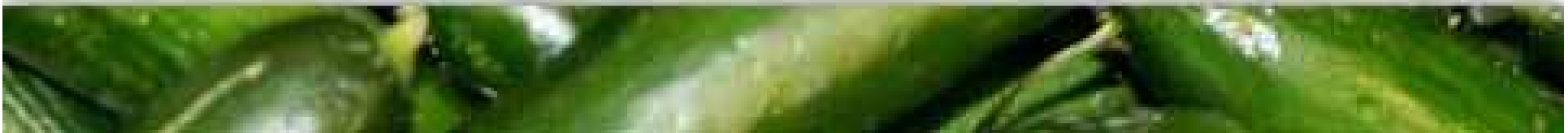
# Future work - Questionnaires

- Questionnaires
  - Seed Guardians
    - Distributed by post
    - 50 responses
    - Information sought:
      - Practices and motivations
  - Member survey
    - Online
    - 35 responses
    - Information sought:
      - Motivations and accession notes



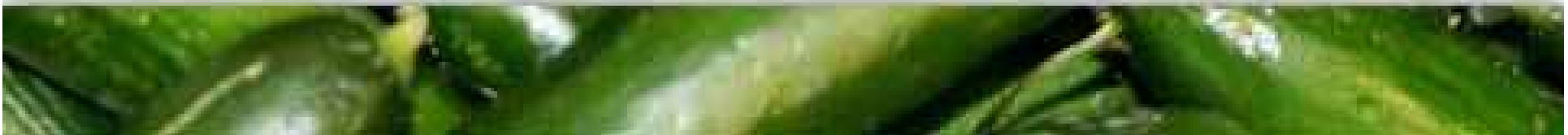
## Conclusions so far

- Large amount of diversity within the collection
- Relationship between genetic and morphological diversity
- Highlights importance of collecting heirlooms and landraces



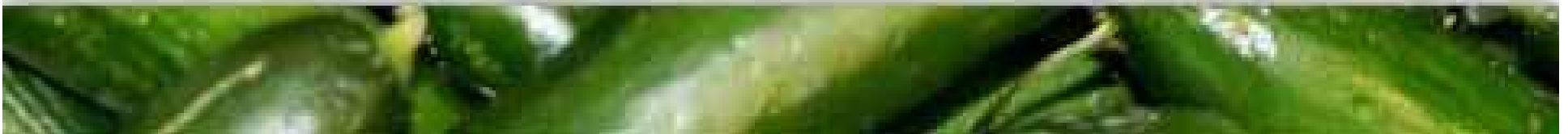
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**Thank you**

Any questions?

