

# Genetic resources of leafy vegetables in Europe: conservation and use

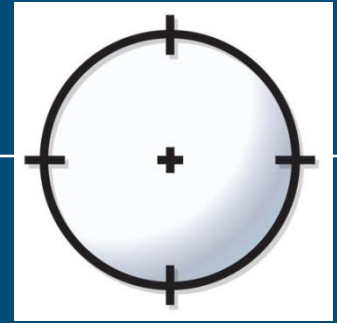
Rob van Treuren & Chris Kik

EUCARPIA Leafy Vegetables

26 August 2011



# Presentation outline



- Goals and achievements of collaborative activities concerning the conservation and use of leafy vegetables in Europe
  - ECPGR working group on leafy vegetables (2003 - 2006)
  - EU-funded project 'Leafy vegetable germplasm, stimulating use' (2007 - 2010)
  - ECPGR working group on leafy vegetables (current focus)

# ECPGR



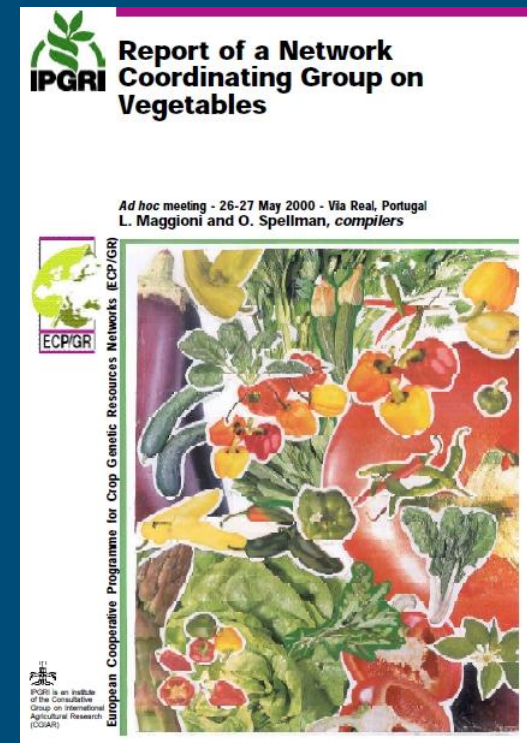
## ■ European Cooperative Programme for Plant Genetic Resources

- Cooperative basis for the conservation and utilization of genetic resources in Europe
  - Financed by member countries
  - Secretariat hosted by Bioversity International (Rome)
- ## ■ Organizational structure
- 9 networks (6 crop networks & 3 thematic networks)
  - Vegetables network: 6 working groups
  - Activities rely on input in kind from WG members

([www.ecpgr.cgiar.org](http://www.ecpgr.cgiar.org))

# ECPGR - crops considered leafy vegetables

- Vegetables grown for the edible leaves
- Included genera (Lebeda & Boukema, 2001)
  - *Cichorium, Lactuca, Spinacia*
  - *Asparagus, Cynara, Diplotaxis, Eruca, Rheum, Valerianella*
  - *Atriplex, Chenopodium, Chrysanthemum, Lepidium, Portulaca, Rumex, Taraxacum, Tetragonia*



# ECPGR working group on leafy vegetables

- Formal establishment in 2003
- ~20 members from the European region
- Priority areas
  - Documentation
  - Regeneration
  - Characterization & evaluation
  - Redundancies within and among collections
  - Crop wild relatives
  - Safety duplication



# ECPGR WG leafy vegetables - achievements

## ■ Documentation

- Inventory of collections and genebank procedures
- International *Lactuca* database (ILDB)

## ■ Characterization

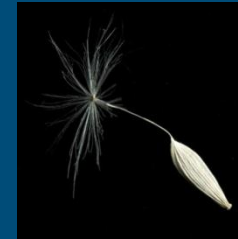
- Status overview
- Minimum descriptor lists
  - Cultivated lettuce
  - Wild *Lactuca*
  - Spinach
  - Leaf chicory
  - Witloof
  - Endive
  - Root chicory

Spinach ( <i>Spinacia</i> spp.)		
Descriptor name	Descriptor state	Note
Seed spines	0 = absent 1 = present	
Stem anthocyanin content	0 = absent 3 = weak 5 = medium 7 = strong	
Leaf shape excluding basal lobes	1 = elliptic 2 = broad elliptic 3 = circular 4 = ovate 5 = broad ovate 6 = triangular	Score at 7th leaf stage
Leaf colour	1 = yellow green 2 = grey green 3 = dark green	Score at 7th leaf stage
Leaf colour intensity	3 = light 5 = medium 7 = dark	Score at 7th leaf stage
Leaf blistering	3 = weak 5 = medium 7 = strong	Score at 7th leaf stage
Bolting time		Number of days from sowing until 15% of plants have stem of 5 cm
Monoeciousness	0 = 0% 3 = 25% 5 = 50% 7 = 75% 9 = 100%	Percentage of monoecious plants

# ECPGR WG leafy vegetables - achievements

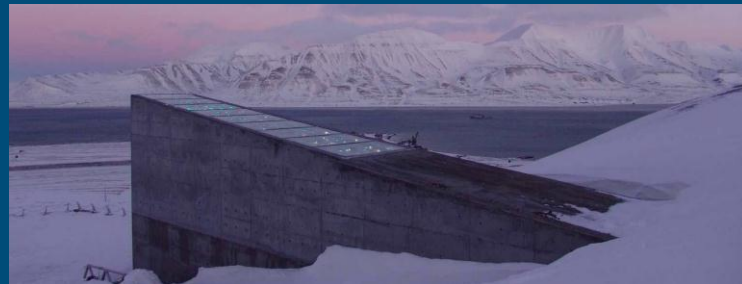
## ■ Regeneration

- Protocol inventory
- Status overview
- Capacity building



## ■ Safety duplication

- Status overview
- Host identification



## ■ Acquisition

- Multicrop collection mission in the Ukraine (2006)
  - ~50 leafy vegetable accessions of landraces and wild relatives

# ECPGR WG on leafy vegetables



## ■ Status of activities in 2006

### ● Documentation

- ILDB update needed
- Databases for other leafy vegetables still lacking
- Limited access to trait data

### ● Acquisition

- Priorities insufficiently determined

### ● Regeneration, characterization and evaluation

- Backlogs still existing for many collections

### ● Safety duplication

- Still lacking for part of the collections



# EU GENRES project

## ■ Title: Leafy vegetable germplasm, stimulating use

### ● Consortium

- 12 organizations
- 10 countries

### ● Budget: 1.12 m€ (EU 0.36)

### ● Duration: 2007-2010

### ● Workpackages

- WP1 Regeneration & characterization
- WP2 Evaluation
- WP3 Utilization & marketing
- WP4 Documentation



(<http://documents.plant.wur.nl/cgn/pgr/leafyveg/>)

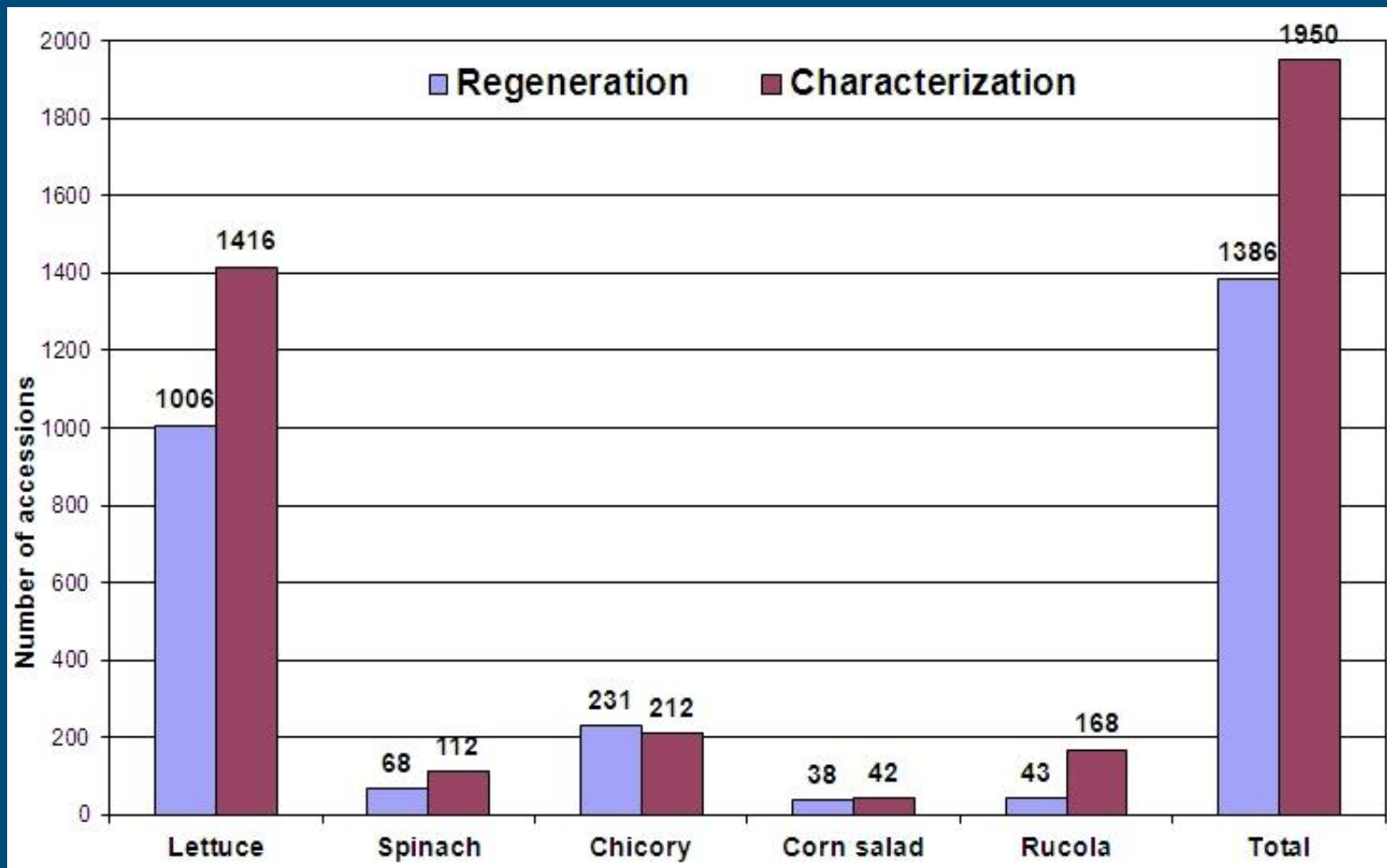
# WP1 Regeneration & characterization

## ■ Objectives

- Develop minimum descriptor lists for *Eruca* and *Valerianella*
- Remove backlogs in regeneration and characterization for collections
- Increase availability of accessions for utilization
- Make characterization data available to the user community



# WP1 - achievements



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# WP2 Evaluation

## ■ Objectives

- Remove backlogs in evaluation for collections
- Generate new data on pest and disease resistance and abiotic characters
- Make evaluation data available to the user community



# WP2 - achievements

Trait	Lettuce	Spinach	Chicory	Rocket	Total
Downy mildew	46	263			309
Root-knot nematodes	30				30
<i>Alternaria cichorii</i>			68		68
<i>Sclerotinia sclerotiorum</i>			31		31
<i>Thielaviopsis basicola</i>			79		79
Postharvest discoloration	28				28
Winterhardiness	20				20
Glucosinolates				37	37
Dry matter, nitrate & oxalic acid		69		20	89
Sesquiterpenes			93		93
Total	124	332	271	57	784

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# WP3 Utilization & marketing

## ■ Objectives

- Evaluate material for utilization and marketing, resulting in specialized and regional products
- Increase product diversity for consumers
- Evaluate material for organic farming systems
- Make data available to the user community



# WP3 - achievements

- 243 genebank accessions tested
  - Lettuce (44), chicory (136), rocket (47), corn salad (16)
- Marketing potential
  - Mostly old, local varieties
  - Cooperation with (organic) farmers, consumers and retailers
    - Agronomic performance in field tests
    - Farmer's assessment
    - Consumer appreciation (taste characteristics, attractiveness)
    - Shelf life
  - Genebank accessions with potential for local markets were identified by all 5 involved project members



# WP3 - examples consumer preference



Roter Butterhäuptel Leitner  
+ intense taste  
+ red colour



Neuseeländer Salat  
+ taste



Dubacek  
+ shape  
+ taste



Kaiser Selbstschluss  
+ taste



Gelb Roter aus Zagreb  
+ shape  
+ big leaves  
+ colour



Flekica  
+ taste



# WP4 Documentation

## ■ Objectives

### ● Databases

- Update the ILDB
- Develop new databases for spinach, chicory and minor leafy vegetables
- Provide access to the experimental data from the other workpackages

- Identify priorities for acquisition based on the contents of the databases
- (Develop safety duplication arrangements where needed)



# WP4 - database development

## ■ Database features

- Accessions available for distribution
- European collections and main collections outside Europe
- 35 passport descriptors, largely following the EURISCO format
- On-line search facility
- Links to institutional databases
- Contact details of curators
- Downloadable data files (Excel format)



# WP4 - databases: central home page



## The International Leafy Vegetables databases

Following up on activities within the ECPGR working group on leafy vegetables, this website was developed within the framework of the EU GENRES project entitled "[Leafy vegetables germplasm, stimulating use](#)" (AGRI-2006-0262). The website provides access to the updated International *Lactuca* Database (ILDB) and to three newly developed databases containing information on accessions of spinach, chicory and minor leafy vegetables, respectively. Data were collected of accessions that in principal are available for distribution. It was aimed to cover all known European collections as much as possible and to include the main collections from outside Europe as well. EURISCO or the old ILDB was used as data source in case no current passport data were received upon request. The databases also provide access to characterization and evaluation data generated within the framework of the EU GENRES project.



### Lettuce

This link provides access to the [International \*Lactuca\* database](#), which is maintained and hosted by the Centre for Genetic Resources, the Netherlands (CGN).



### Spinach

This link provides access to the [International spinach database](#), which is maintained and hosted by the Centre for Genetic Resources, the Netherlands (CGN).



### Chicory

This link provides access to the [International chicory database](#), which is maintained and hosted by the Groupe d'Etudes et de Contrôle des Variétés et des Semences (GEVES).



### Minor Leafy Vegetables

This link provides access to the [International minor leafy vegetables database](#), which is maintained by the Leibniz-Institute of Plant Genetics and Crop Plant Research (IPK) and hosted by the Centre for Genetic Resources, the Netherlands (CGN).

(<http://documents.plant.wur.nl/cgn/pgr/LVintro>)


# WP4 - databases: on line search facility

[Home](#) [Search](#) [Download](#) [Description](#) [Contributors](#) [Species](#)

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## International *Lactuca* database searchform

This form gives access to the *Lactuca* passport data. The search facility is using the most relevant EURISCO standard descriptors. Enter your search criteria and press the 'Search!' button.



Genus:

Species:

Subtaxon:

Subcrop type:

Country of origin:

Status of sample:

Search for (part of) the accession name:

Search for (part of) the accession number:

Search for accessions with research data:

Holding institute:

Order results by:  
 Species  Institute  Country of origin  Accession name  Accession number

Order direction:  
 Ascending  Descending

Maximum number of records per page:

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# WP4 - databases: search results

[Home](#) [Search](#) [Download](#) [Description](#) [Contributors](#) [Species](#)

## International *Lactuca* Database search results

This is the list of accessions that correspond to the query as formulated in the searchform. The accession number is linked to a page containing all available data of the selected accession. Do not bookmark this page because it is dynamically generated and will probably not be available at a next visit.



Accession name: Forellenschluss

Total hits: 5

Displaying Page 1 of 1, records 1 to 5

Institute	Accession number	Species	Accession name	Sample status	Country	Research data
BGR001	<a href="#">1991-LAC-SA-14</a>	<i>Lactuca sativa</i>	FORELENSCHLUSS DEZ			No
NLD037	<a href="#">CGN09375</a>	<i>Lactuca sativa</i>	Forellenschluss; Grazer Forellenschluss	Advanced/improved cultivar	Austria	Yes
CZE122	<a href="#">09H5700521</a>	<i>Lactuca sativa</i> var. <i>capitata</i>	Forellenschluss	Advanced/improved cultivar	Austria	No
AUT046	<a href="#">SA017</a>	<i>Lactuca sativa</i> var. <i>longifolia</i>	Forellenschluß Leitner	Other	Austria	Yes
AUT046	<a href="#">SA029</a>	<i>Lactuca sativa</i> var. <i>longifolia</i>	Forellenschluß	Breeding/research material	Austria	Yes

# WP4 - databases: accession info

Identifiers	
Holder institute:	NLD037 Centre for Genetic Resources, the Netherlands Wageningen
Accession number:	<a href="#">CGN09375</a>
Accession name:	Forellenschluss; Grazer Forellenschluss
Sample status:	Advanced/improved cultivar
Classification	
Cropname:	Lettuce
Subcrop type:	Cos lettuce
Genus:	<i>Lactuca</i>
Species:	<i>sativa</i>
Subtaxon:	
Origin information	
Country of origin:	Austria
Collection site:	
Latitude:	
Longitude:	
Elevation:	
Collecting date of original sample:	
Collecting source:	Institute, Experimental station, Research organization, Genebank
Collecting number:	
Collecting institute:	
Breeding institute:	Austrosaat, Wien, Austria
Donor institute:	Austrosaat, Wien, Austria
Donor number:	
Other number:	
Ancestry:	
Other information	
Aquisition date:	19880927
Remarks:	
File generation date:	20071015
Research data	
Available files:	<a href="#">NLD037 2007 cultivated lettuce.xls</a> <a href="#">NLD037 2008 cultivated lettuce.xls</a> <a href="#">NLD037 2010 cultivated lettuce.xls</a>

## Institutional database

- Additional info
- Photo documentation
- On-line ordering



## Project data

# WP4 - databases: project data

	A	B	C	D
1	Institute:	CGN		
2	Country:	Netherlands		
3	Contact:	Liesbeth de Groot		
4				
5	<b>Experiment description</b>			
6				
7				
8	Experiments were conducted at the experimental field station "Nergena" located in Wageningen. Sowing was			
9	performed on the 14 <sup>th</sup> of March 2008 and 30 plants per accession were transferred to the field on the 23 <sup>rd</sup> of April			
10	2008. Plants were arranged in two rows with 30 cm inter-plant distance. Plants were scored according to the			
11	minimum descriptor list developed for cultivated lettuce. In addition, several other plant features were recorded.			
12				
13				

	A	B	C	D	E	F	G	H
1	<b>Cultivated lettuce (<i>Lactuca sativa</i>)</b>							
2								
3	<b>Scoring protocol in case of heterogeneity</b>							
4	Multiple scores are used in order of decreasing frequency of observation							
5	A single 'x' is used to indicate large frequency differences, and a double 'x' for very large differences							
6					<b>Minimum descriptors</b>			
7					Seed colour	Leaf anthocyanin content	Outer leaf colour intensity	
8	<b>INSTCODE</b>	<b>ACCENUMB</b>	<b>SPECIES</b>	<b>ACCNAME</b>		At harvest maturity	At harvest maturity	At harvest ma
9	NLD037	CGN04492	<i>Lactuca sativa</i>	Amerikanischer Brauner	1	6	5	6
10	NLD037	CGN04504	<i>Lactuca sativa</i>	Attrazione	1	0	2	3
11	NLD037	CGN04515	<i>Lactuca sativa</i>	Batavia Doree de Printemps	1	0	1	5
12	NLD037	CGN04574	<i>Lactuca sativa</i>	Du Bon Jardinier	1	2	3	3
13	NLD037	CGN09375	<i>Lactuca sativa</i>	Forellenschluss	1	5	2	5
14	NLD037	CGN04580	<i>Lactuca sativa</i>	Frisee d'Amerique	1	6	5	6
15	NLD037	CGN04594	<i>Lactuca sativa</i>	Gotte Lente a Monter	4	0	2	4
16	NLD037	CGN04613	<i>Lactuca sativa</i>	Hilde	1	0	2	3
17	NLD037	CGN04618	<i>Lactuca sativa</i>	Hohlblattriger Butter	1	0	2	3
18	NLD037	CGN04755	<i>Lactuca sativa</i>	Joy of the Village	1	0	2	4
19	NLD037	CGN04692	<i>Lactuca sativa</i>	Merveille des 4 Saisons	4	8	5	7
20	NLD037	CGN04707	<i>Lactuca sativa</i>	Oak Leaf	1	0	2	5
21	NLD037	CGN04814	<i>Lactuca sativa</i>	Regina di Maggio	1	2	1	3
22	NLD037	CGN04489	<i>Lactuca sativa</i>	Salad Bowl	4	0	1	3

0=absent  
3=weak  
5=medium  
7=strong

# WP4 - databases: download section

## Download section of the International Chicory Database

All available passport data of accessions included in the International Chicory Database are downloadable as zipped Excel file. This zip file also contains the decoding tables, except for the FAO institutes table that is available on the [Wiews website](#) (PGR > Download).

Characterization and evaluation data generated within the framework of the EU GENRES project entitled "[Leafy vegetables germplasm stimulating use](#)" (AGRI-2006-0262) are also downloadable as zipped Excel file.

- [Passport data](#)
- Characterization data
  - [Endive 2008 CHE063](#)
  - [Endive 2009 CHE063](#)
  - [Endive 2007 FRA215](#)
  - [Endive 2008 FRA215](#)
  - [Leaf Chicory 2008 CHE063](#)
  - [Leaf Chicory 2009 CHE063](#)
  - [Leaf Chicory 2007 FRA215](#)
  - [Leaf Chicory 2008 FRA215](#)
  - [Leaf Chicory 2009 FRA215](#)
  - [Leaf Chicory 2009-2010 SVN019](#)
- Evaluation data
  - [Chicory Alternaria 2008 FRA215](#)
  - [Chicory Alternaria 2009 FRA215](#)
  - [Chicory Alternaria 2010 FRA215](#)
  - [Chicory Sclerotinia 2008 FRA215](#)
  - [Chicory Sclerotinia 2009 FRA215](#)
  - [Chicory Thielaviopsis 2009 FRA215](#)
  - [Chicory Thielaviopsis 2010 FRA215](#)
  - [Chicory sensory evaluation 2010 ITA330](#)
  - [Chicory sesquiterpene 2010 ITA330](#)

Comments and questions to: [Pascal Coquin](#).

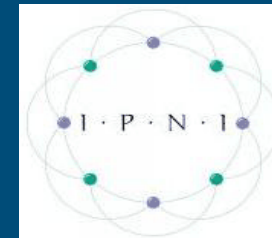


# WP4 - databases: contents July 2011

	Lettuce	Spinach	Chicory	Minors	Total
# Collections	30	25	21	53	129
# Accessions	11697	2027	1766	2149	17639
Data files					
- Characterization	21	6	10	11	48
- Evaluation	9	5	9	3	26
- Utilization	4			2	6
Total	34	11	19	16	80

# WP4 - acquisition priorities

- Inventory of species and geographic distribution areas
  - 7 taxonomic databases & available literature
  - Gene pool concept (Harlan & de Wet)
  - Regional subdivision of the UN statistics division
  - Comparison database contents



# WP4 - acquisition priorities: spinach

## ■ Priorities

- *S. tetrandra*
- *S. turkestanica*
- *S. oleracea*
  - Iran
  - North Africa



	<i>S. oleracea</i>	<i>S. tetrandra</i>	<i>S. turkestanica</i>	unknown
Europe	636			96
Asia	741	8	5	95
Africa	10			5
Americas	14			26
Oceania	3			
unknown	365	4	9	
Total	1769	12	14	222

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# Follow-up action: *Spinacia* collecting

- Central Asia (2008) and Caucasus (2011)
- Cofunded by Dutch breeding companies
- Formal arrangements with target countries
- Material to be added to the CGN collection

<i>Spinacia</i>	<i>oleracea</i>	<i>tetrandra</i>	<i>turkestanica</i>
Armenia	4	16	
Azerbaijan	5	21	
Georgia	5	2	
Tajikistan			30
Uzbekistan	2		36
Total	16	39	66



# ECPGR project AEGIS



## ■ A European Genebank Integrated System

### ● Key features

- Virtual European collection
- Genetically unique and important accessions for Europe
- Conservation according to agreed minimum standards
- Ensured availability for breeding and research
- Using mechanisms, procedures and instruments of the ITPGRFA (e.g. sMTA)
- MoU signed by 27 countries

### ● Working group on leafy vegetables

- Development of crop-specific minimum genebank standards
- Nomination of accessions for European collection



([www.aegis.cgiar.org](http://www.aegis.cgiar.org))

# Acknowledgements

