



# **“Prerequisites for effective utilization of PGR and Information System”**

**3<sup>rd</sup> Part**

**Belul Gixhari**

**INSTITUTE OF PLANT GENETIC RESOURCES  
AGRICULTURAL UNIVERSITY OF TIRANA**

**Tirana, 2019**

# 1. Assessing the genetic diversity

1.1 Geographic diversity,

1.2 Genetic diversity,

- Representativeness of diversity,
- Gaps analysis,

1.3 Assessment of cultivated crops diversity.

## 2. Prerequisites for effective utilization of PGR

2.1 Organization of germplasm & documentation

2.2 Utilization of C&E data in practice.

## 3. Information System

# 2

## **Prerequisites for effective utilization of PGR**

**2.1 Organization of germplasm & documentation.**

2.2 Utilization of C&E data in practice

## 2.1 Organization of germplasm & documentation (methods & criteria)

- **Organization of germplasm:**  
target collections, responsibility of germplasm.
- **Classification of crops diversity:**  
cultivated species, wild species, breeding materials.

### □ Organizing documentation data

- **Passport data** for genetic materials:
  - application of Descriptor Lists
  - application of EURISCO descriptors.
- **Characterization and evaluation data:**
  - application of Multicrops Descriptor Lists
  - application of EURISCO descriptors.
  - application of field trials.

# Results: Organizing germplasm data

## Germplasm target collections

- **Base collections: 3317 acc., 106 species.**
- **Active collections: 270 acc., 19 species.**
- **Pendent collections (stocks): 594 acc., 50 species.**
- **Field collections: 663 acc., 38 species.**
- **Responsibility of germplasm: researcher, curator, etc**
- **Development of NI database: 4345 acc. 148 species;**

## Classification of crops diversity

### cultivated species:

- landraces or
- traditional local varieties, **(51%),**
- **wild species:**
  - for direct use,
  - indirect use,
  - potentially utilizable.
- **Breeding lines, advanced cultivars/** **(22%).**
- **commercial varieties.** **(2%).**
- **special stocks of cultivated crops.**

# Organizing documentation = genebank procedures

- 1\_ Exploring
- 2\_ Collecting
- 3\_ Sample Processing
- 4\_ Registration
- 5\_ Conservation
- 6\_ Characterization & Evaluation
- 7\_ Regeneration
- 8\_ Documentation & Information
- 9\_ Distribution
- 10\_ Management

ACR21

1	NICODE	INSTCODE	ACCENUMB	COLLNUMB	COLLCODE	GENUS	SPECIES	SPA	S	CROPM	ACCENNAME	ACQDATE	ORIGC	COLLSITE	LATITUDE	LONGITUDE	ELEVATION	COLLDATE	BR	SAMP	AN	COLLORCO	DONORHU	DT	DUPLSITE	STG
868	ALB	ALB017	AGB0867	KHP140	ALB006	Zea mays	L	maize			Caragati	20031008	ALB	Mat	4135-N	19569-E	350	1976		300	40	ALB006	MO0339	ALB006	13	
869	ALB	ALB017	AGB0868	KHP141	ALB006	Zea mays	L	maize			Gelgori / barzi	20031008	ALB	Permet	4013-N	02021-E	350	1976		300	40	ALB006	MO0340	ALB006	13	
870	ALB	ALB017	AGB0869	KHP142	ALB006	Zea mays	L	maize			Miser / barzi	20031008	ALB	Permet	4013-N	02021-E	350	1976		300	40	ALB006	MO0341	ALB006	13	
871	ALB	ALB017	AGB0870	KHP143	ALB006	Zea mays	L	maize			I bardhe / me	20031008	ALB	Tropoje	4224-N	02101-E	600	1976		300	40	ALB006	MO0342	ALB006	13	
872	ALB	ALB017	AGB0871	KHP144	ALB006	Zea mays	L	maize			Dukaj	20031008	ALB	Permet	4013-N	02021-E	450	1976		300	40	ALB006	MO0343	ALB006	13	
873	ALB	ALB017	AGB0872	KHP145	ALB006	Zea mays	L	maize			Ceserast	20031008	ALB	Puke	4202-N	01954-E	400	1976		300	40	ALB006	MO0344	ALB006	13	
874	ALB	ALB017	AGB0873	KHP146	ALB006	Zea mays	L	maize			Flat	20031008	ALB	Korpe	4035-N	02040-E	600	1976		300	40	ALB006	MO0345	ALB006	13	
875	ALB	ALB017	AGB0874	KHP147	ALB006	Zea mays	L	maize			Fare madh p	20031008	ALB	Diber	4140-N	02101-E	400	1976		300	40	ALB006	MO0346	ALB006	13	
876	ALB	ALB017	AGB0875	KHP148	ALB006	Zea mays	L	maize			Mashkulure	20031008	ALB	Gjrokdaster	4009-N	02110-E	400	1976		300	40	ALB006	MO0347	ALB006	13	
877	ALB	ALB017	AGB0876	KHP149	ALB006	Zea mays	L	maize			Fara Gurres	20031008	ALB	Shkoder	4215-N	01946-E	500	1976		300	40	ALB006	MO0348	ALB006	13	
878	ALB	ALB017	AGB0877	KHP150	ALB006	Zea mays	L	maize			Miser Gushu	20031008	ALB	Puke	4202-N	01954-E	500	1976		300	40	ALB006	MO0349	ALB006	13	
879	ALB	ALB017	AGB0878	KHP151	ALB006	Zea mays	L	maize			Fara e Lusha	20031008	ALB	Tropoje	4224-N	02101-E	600	1976		300	40	ALB006	MO0350	ALB006	13	
880	ALB	ALB017	AGB0879	KHP152	ALB006	Zea mays	L	maize			Pa emerim	20031008	ALB	Kolonje	4049-N	01937-E	700	1976		300	40	ALB006	MO0351	ALB006	13	
881	ALB	ALB017	AGB0880	KHP153	ALB006	Zea mays	L	maize			I mesem	20031008	ALB	Shkoder	4215-N	01946-E	250	1976		300	40	ALB006	MO0352	ALB006	13	
882	ALB	ALB017	AGB0881	KHP154	ALB006	Zea mays	L	maize			Gushak Pes	20031008	ALB	Kukes	4211-N	02012-E	400	1976		300	40	ALB006	MO0353	ALB006	13	
883	ALB	ALB017	AGB0882	KHP155	ALB006	Zea mays	L	maize			Mesulek	20031008	ALB	Kukes	4211-N	02012-E	400	1976		300	40	ALB006	MO0354	ALB006	13	
884	ALB	ALB017	AGB0883	KHP156	ALB006	Zea mays	L	maize			Regj / verthe	20031008	ALB	Shkoder	4215-N	01946-E	400	1976		300	40	ALB006	MO0355	ALB006	13	
885	ALB	ALB017	AGB0884	KHP157	ALB006	Zea mays	L	maize			Gushak i ve	20031008	ALB	Shkoder	4215-N	01946-E	450	1976		300	40	ALB006	MO0356	ALB006	13	
886	ALB	ALB017	AGB0885	KHP158	ALB006	Zea mays	L	maize			Regj / vedthe	20031008	ALB	Tropoje	4224-N	02110-E	450	1976		300	40	ALB006	MO0357	ALB006	13	
887	ALB	ALB017	AGB0886	KHP159	ALB006	Zea mays	L	maize			Kolesati	20031008	ALB	Sarande	3952-N	02000-E	100	1976		300	40	ALB006	MO0358	ALB006	13	
888	ALB	ALB017	AGB0887	KHP160	ALB006	Zea mays	L	maize			Bolet kuqe v	20031008	ALB	Diber	4140-N	02027-E	450	1976		300	40	ALB006	MO0359	ALB006	13	
889	ALB	ALB017	AGB0888	KHP161	ALB006	Zea mays	L	maize			I mesem	20031008	ALB	Shkoder	4215-N	01946-E	200	1976		300	40	ALB006	MO0360	ALB006	13	
890	ALB	ALB017	AGB0889	KHP162	ALB006	Zea mays	L	maize			Fara e dyte	20031008	ALB	Flashtpi	4140-N	02027-E	450	1976		300	40	ALB006	MO0361	ALB006	13	
891	ALB	ALB017	AGB0890	KHP163	ALB006	Zea mays	L	maize			I verthe / me	20031008	ALB	Tropoje	4224-N	02110-E	500	1976		300	40	ALB006	MO0362	ALB006	13	
892	ALB	ALB017	AGB0891	KHP164	ALB006	Zea mays	L	maize			Fara e kuzh	20031008	ALB	Tropoje	4224-N	02101-E	500	1976		300	40	ALB006	MO0363	ALB006	13	
893	ALB	ALB017	AGB0892	KHP165	ALB006	Zea mays	L	maize			16-19 mesi	20031008	ALB	Fier	4044-N	01936-E	100	1976		300	40	ALB006	MO0364	ALB006	13	
894	ALB	ALB017	AGB0893	KHP166	ALB006	Zea mays	L	maize			Fara e dyte	20031008	ALB	Diber	4140-N	02027-E	450	1976		300	40	ALB006	MO0365	ALB006	13	
895	ALB	ALB017	AGB0894	KHP167	ALB006	Zea mays	L	maize			Geshm	20031008	ALB	Shkoder	4215-N	01946-E	300	1976		300	40	ALB006	MO0366	ALB006	13	

Microsoft Access

INSTITUTE	NICODE	INSTCODE	ACCENUMB	GENUS	SPECIES	SPAUTH	SUBTAXA	SUBTAUTH	ACCENNAME	CROPMNAME	COLLNUM
ALB017	AGB0872	ALB006	3 Lens	angulatus							1903
ALB017	AGB0873	ALB006	4 Lens	angulatus							1925
ALB017	AGB0874	ALB006	5 Lens	angulatus							1928

# Results: Passport data

## EURISCO Descriptors

<b>0. National Inventory code (NICODE)</b>	Example: ALB
<b>1. Institute code (INSTCODE)</b>	Example: ALB017
<b>2. Accession number (ACCENUMB)</b>	Example: AGB0789
<b>3. Collecting number (COLLNUMB)</b>	Example: FE;HS027-11
<b>4. Collecting institute code (COLLCODE)</b>	Example: ALB017
<b>5. Genus (GENUS)</b>	Example: Allium
<b>6. Species (SPECIES)</b>	Example: paniculatum
<b>7. Species authority (SPAUTHOR)</b>	Example: L.
<b>8. Subtaxa (SUBTAXA)</b>	Example: subsp. fuscum
<b>9. Subtaxa authority (SUBTAUTHOR)</b>	Example: (Waldst. et Kit.) Arc.
<b>10. Common crop name (CROPNAME)</b>	Example: malting barley
<b>11. Accession name (ACCENAME)</b>	Example: Rheinische Vorgebirgstrauben; Emma; Avlon
<b>12. Acquisition date (ACQDATE)</b>	Example: 1968----; Example: 20020620
<b>13. Country of origin (ORIGCTY)</b>	Example: ALB
<b>14. Location of collecting site (COLLSITE)</b>	Ex: 7km south of Curitiba in the state of Parna
<b>15. Geographical coordinates</b>	
<b>16. Elevation of collecting site [masl] (ELEVATION)</b>	Example: 763
<b>17. Collecting date of sample [YYYYMMDD] (COLLDATE)</b>	Example: 1968----; Ex: 20020620
<b>18. Breeding institute code (BREDCODE)</b>	FAO Institute Code of the institute that has bred the material.
<b>19. Biological status of accession (SAMPSTAT)</b>	
100) Wild; 110) Natural; 120) Semi-natural/wild; <b>200)</b> Weedy; <b>300)</b> Traditional cultivar/landrace	
<b>400)</b> Breeding/research material; 410) Breeder's line; 411) Synthetic population; 412) Hybrid	
413) Founder stock/base population; 414) Inbred line (parent of hybrid cultivar); 415) Segregating population;	
420) Mutant/genetic stock; 421) Mutant, 423) Other gene stocks <b>500)</b> Advanced/improved cultivar; <b>600)</b> GMO,	
<b>999)</b> Other (Elaborate in REMARKS field)	

## Results:

Organizing germplasm on target collections & classification of crops diversity

= was found **useful & practical** in management of a target collection

**Organizing documentation** according to genebank procedures using international standards

= was very **practical & effective** in management of germplasm

Using Standard Descriptors for Passport data:

- = **very useful and effective** in:
  - management of plant germplasm
  - identification of germplasm &
  - accessibility information system



# 2

## **Prerequisites for effective utilization of PGR**

2.1 Organization of germplasm & documentation

**2.2 Utilization of C&E data in practice**

# Characterization & evaluation: criteria

**Components of variation:  $P = G + E + G * E$**

## **Characterization, basic criteria**

- Description of specific characteristics.
- Characteristics highly inherited (qualitative traits).
- Easy to see and score.
- Expressed consistently in all environments.
- Characters check for the genetic integrity.

## **Evaluation, basic criteria**

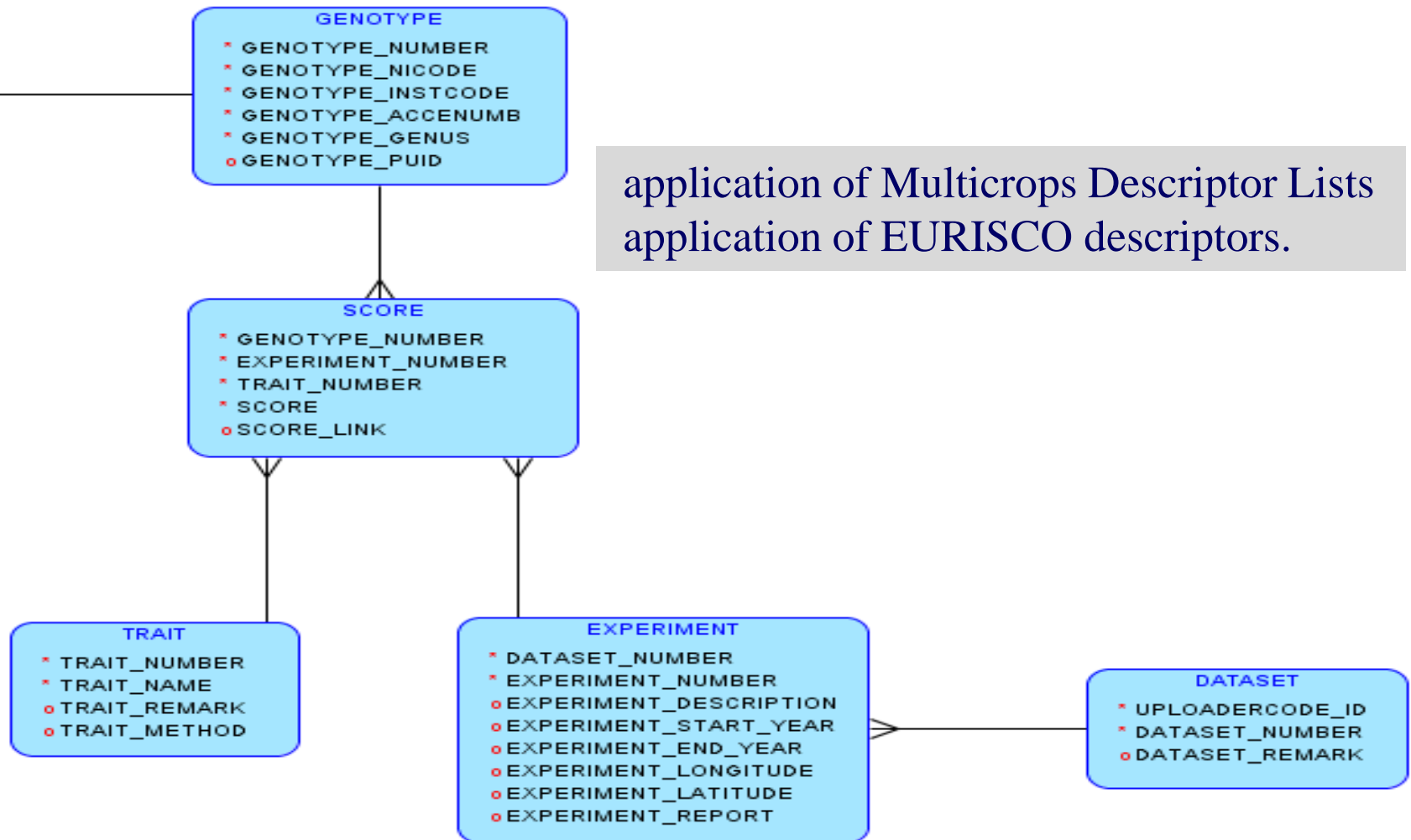
- Carried out in trials with replications.
- Retrieve all possible information on quantitative characteristics.
- Standards, and possibly methods and dataformats
- Photo documentation,
- Products / product documentation

## **Statistical analysis (C&E data)**

- ANOVA, High significance Test, PCo analysis, Genetic Distances, Correlations, PCA.

# Results: Characterization & evaluation data

application of Multicrops Descriptor Lists  
application of EURISCO descriptors.



# Results: Characterization & evaluation data

## Results C&E:

- 1) identified germplasm (genotypes; high inherited traits; useful traits),
- 2) select germplasm (the best acc., as parents)
- 3) identified useful traits=- **important for breeding & production.**

## Conclusions: organizing germplasm & documentation

- Prerequisites for effective utilization of plant germplasm.
  - Passport data facilitate identification & germplasm accessibility.
  - Gene reserves for breeding and pre breeding programs.
  - **Traits useful for plant breeding & production.**
  - Utilization of collected materials (**landraces and wild species**).
  - Designation of Origin (especially): **PDO**- protected designation of origin;  
**PGI**- protected geographical indication;
- = **very effective in management of plant germplasm:**  
(regeneration, characterization, distribution, & in sustainable farmer seeds).

## 2.2 Utilization of C&E data in practice

### Breeding and pre breeding,

- **In genebank breeding has low priority** because:
  - Steps before breeding program,
  - Long term investment,
  - Creation of large population of potential parental lines,
  - Utilization of secondary and tertiary gene pool,
  - In-crossing of unwanted traits,

**But:**

**C&E trials are very important** because:

- **identified important traits useful for plant breeding & production.**

# Results: C&E data in practice

## Bio-morphological & molecular data.

- Pea 28 acc\*\*. (15 QL traits + 23 QN characters).
- Pea 28 acc. ( **14 RBIP markers**)  
14 retrotransposon-based insertion polymorphism (RBIP)
- Grass pea 14 acc\*\*. (10 QL traits + 14 QN characters).
- Grass pea 14 acc. (**7 RAPD markers**).  
Random Amplified Polymorphic DNA (RAPD)
- Tobacco 24 acc. (10 QL traits + 14 QN characters).
- Sorghum 20 acc. (12 QL traits + 23 QN characters) (2018-19)
- Sorghum 22 acc. **DNA analysis in Germany.**

**\*\*Pea & Grass pea data in collaboration with co-authors**

## Results: Pea 28 acc. (15 QL traits + 23 QN characters + 14 RBIP markers)

- **C&E** trials (morphological & mol. markers) **identified** diversity among pea genotypes.
- **Genetic distances/similarity** by mol. markers showed **higher similarity** in comparison to **conventional** morphological **methods** (UPOV).
- **Mol. markers**  $r = 0.71 > r = 0.67$  (morphological traits) demonstrated the importance of mol. markers in characterization.
- The relationship: **morphological** x **mol. markers** results = **68%**.
- **Results are beneficial to pea germplasm database & to breeding programs in pea.**



**Results: Grass pea 14 acc. (10 QL traits + 14 QN characters + 7 RAPD markers)**

## **Conclusion:**

### **The field trials & factorial analysis:**

- permitted the **evaluation of genetic variability** of peas landraces group,
- identified the **most important agro-morphological traits** with potential for sustainable the future peas & grass pea breeding programs.
- **Factorial analysis** ( $PCA_{123} = 80.5\%$  of var.) found: **agro-morphological traits useful for breeding & production:**
- (**agro-morphological** traits as DM, DP, DF, PH, LLL ( $PC_1$ ); LS, NPP, NSP, YG ( $PC_2$ ), highly correlated ( $r: 0.72$  to  $0.93$ ): can be **used successfully as morphological markers.**
- The **amount of genetic variability** found **suggest** the collected landraces **have variability available to the breeders,**
- **Variability** is sufficient for the creation of new favourable gene combinations to sustain field grass pea breeding programs.



## Statistical analysis: trials data

(morphological & molecular markers)

Morphological		ANOVA		Eigenvectors		
Quantitative Traits		F Ratio	Prob > F	PC1	PC2	PC3
Days to flowering	DF	1850.328	<.0001*	0.3122	0.2089	0.0612
Days to pods	DP	1685.228	<.0001*	0.3194	0.1986	0.0429
Days to maturity	DM	7834.159	<.0001*	0.3157	0.2048	0.0448

### Statistical analysis (C&E data)

- ANOVA, High significance Test, PCo analysis, Genetic Distances, Correlations, PCA.

Leaflet length	LLL	01.9909	<.0001*	0.3072	0.2175	0.0007
Leaflet width	LLW	1.3038	0.2491	0.0877	-0.1674	0.5727
Pod-bearing position	PBP	2.1713	0.0291*	0.0218	-0.0120	0.1222
Pod-bearing length	PBL	23.0454	<.0001*	0.3178	-0.1942	-0.0347
No. of pods per plant	NPP	15.9580	<.0001*	-0.2298	0.2806	0.0559
Beak length of pod	BLP	18.6165	0.0508	0.3168	-0.1964	-0.0534
Pod length	PL	9.6813	<.0001*	-0.3578	0.0014	0.0396
Pod width	PW	3.4997	0.0010*	-0.2306	-0.2051	0.1966
No. of seeds per pod	NSP	37.8573	<.0001*	-0.0624	0.3716	0.0122
Seed size (diameter)	SS	3.3226	0.0016*	0.1273	-0.3078	0.1397
1000 seed weight	100SW	13.2197	<.0001*	0.1544	-0.3250	0.1686
Yield per genotype	YG	4.3312	0.0001*	0.0106	0.3298	0.1763

# Statistical analysis: Pea field trials data & molecular markers

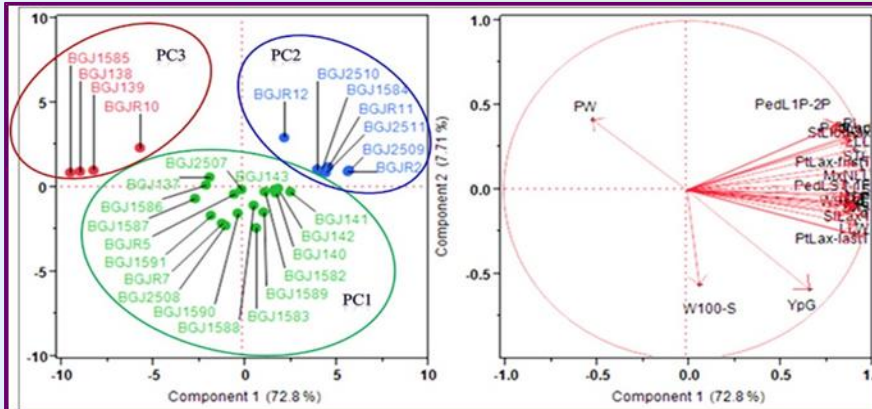


Fig. 1. dimensional relationships among the 28 pea genotypes based on morphological quantitative traits revealed by PCo analyses.

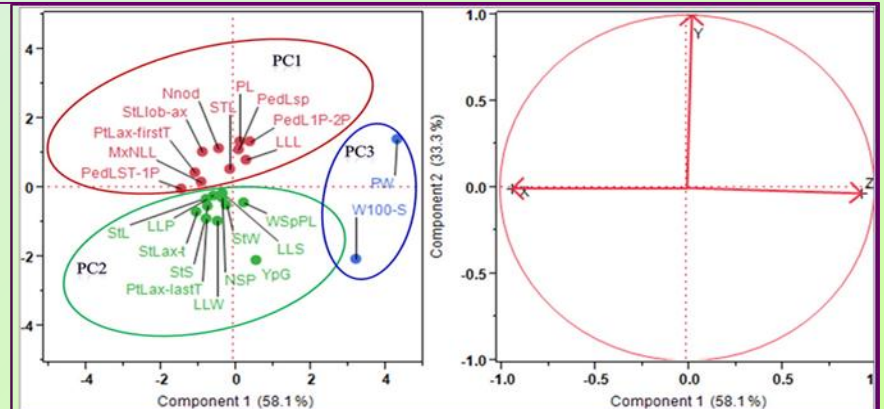


Fig 2. dimensional relationships between the most important pea morphological quantitative traits revealed by PCo analyses.

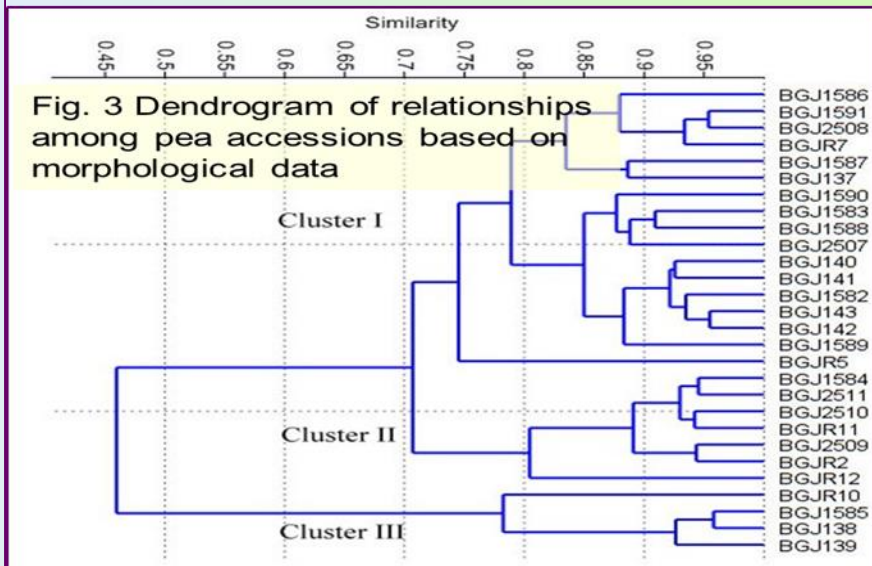
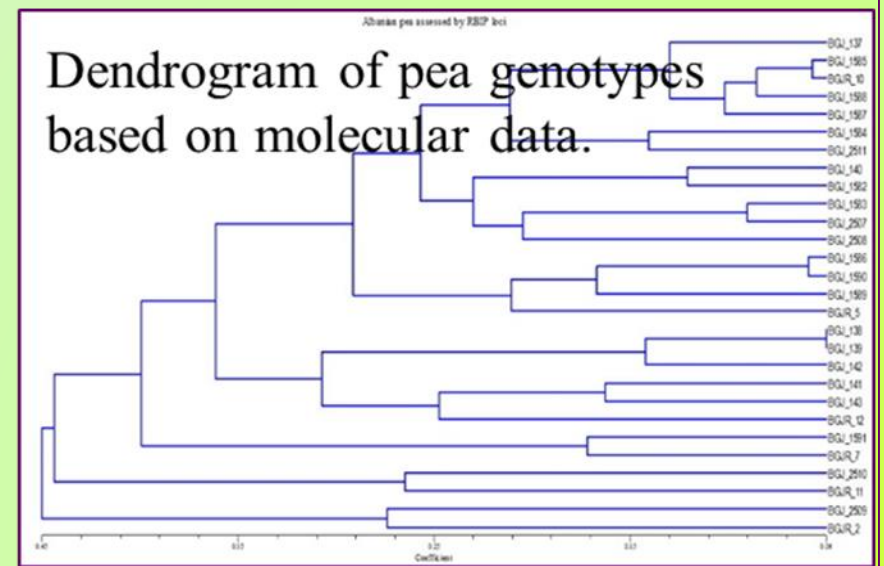


Fig. 3 Dendrogram of relationships among pea accessions based on morphological data



Dendrogram of pea genotypes based on molecular data.

# Statistical analysis: Grass pea field trials data & molecular markers

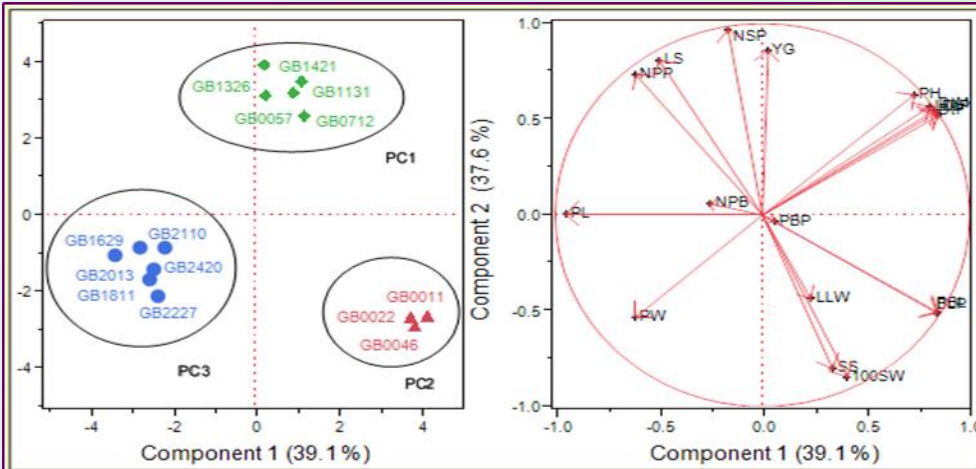


Fig 2. Relationships: grass pea genotypes x morphological quantitative traits (by PCA).

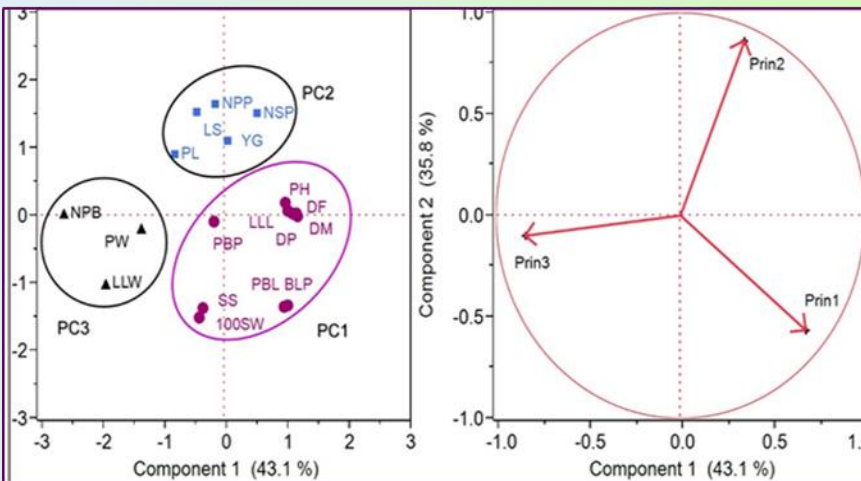


Fig 3. Dimensional relationships among agro-morphological traits (by PCA)

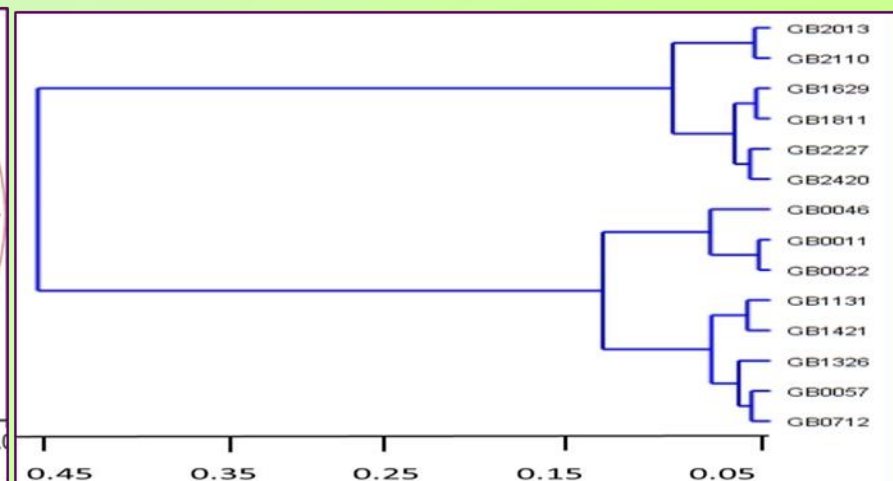


Figure 4. Dendrogram constructed on the basis of RAPD data in 14 genotypes of grass pea

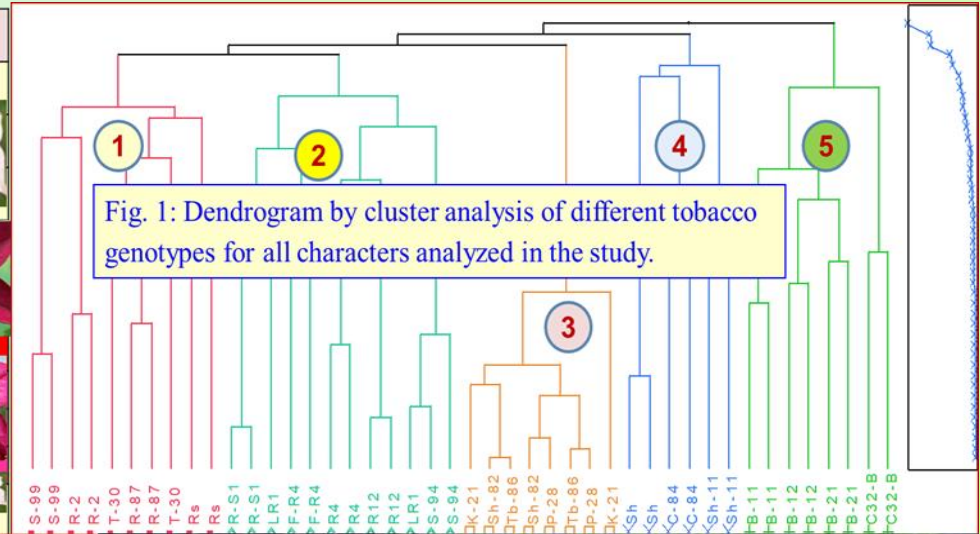
# Results: Pea & grass pea genotypes (Photo courtesy: V. Hobdari)



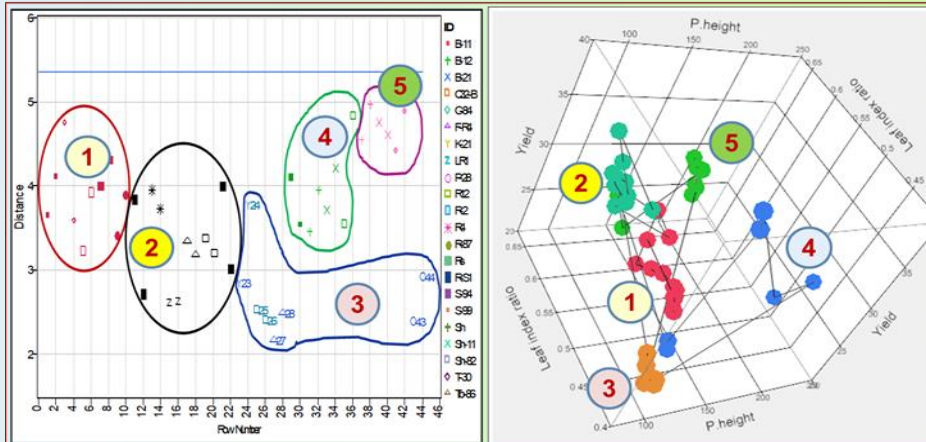
# Utilization of C&E data in practice

**Characterization of Tobacco 24 acc.** (10 QL traits + 14 QN characters).

Genotypes	Flower color	Notes	Corolla Color	Genotypes	Flower color	Notes	Corolla Color
S-99	Medium pink	3		K-21	White-cream	1	
T-30	Medium pink	3		Sh-82	White-cream	1	
R-2	Medium pink	3		Tb-86	White-cream	1	
Rs	Medium pink	3		B-11	Red	5	
R-87	Medium pink	3		B-12	Red	5	
R-S1	Light pink	2		B-21	Red	5	
R4	Light pink	2		C32-B	Red	5	
LR1	Light pink	2		Sh	Dark pink	4	
F-R4	Light pink	2		Sh-11	Dark pink	4	
R12	Light pink	2		C-84	Dark pink	4	
S-94	Light pink	2		P-28	White-cream	1	






**Tobacco genotypes distances according to outlier analysis of Mahalanobis and their views in Scatterplot 3D**



# Utilization of C&E data in practice

**Characterization of Tobacco 24 acc.** (10 QL traits + 14 QN characters).

Genotypes	Flower color	Notes	Corolla Color	Genotypes	Flower color	Notes	Corolla Color
S-99	Medium pink	3		K-21	White-cream	1	
T-30	Medium pink	3		Sh-82	White-cream	1	
R-2	Medium pink	3		Tb-86	White-cream	1	
Rs	Medium pink	3		B-11	Red	5	
R-87	Medium pink	3		B-12	Red	5	
R-S1	Light pink	2		B-21	Red	5	
R4	Light pink	2		C32-B	Red	5	
LR1	Light pink	2		Sh	Dark pink	4	
F-R4	Light pink	2		Sh-11	Dark pink	4	
R12	Light pink	2		C-84	Dark pink	4	
S-94	Light pink	2		P-28	White-cream	1	

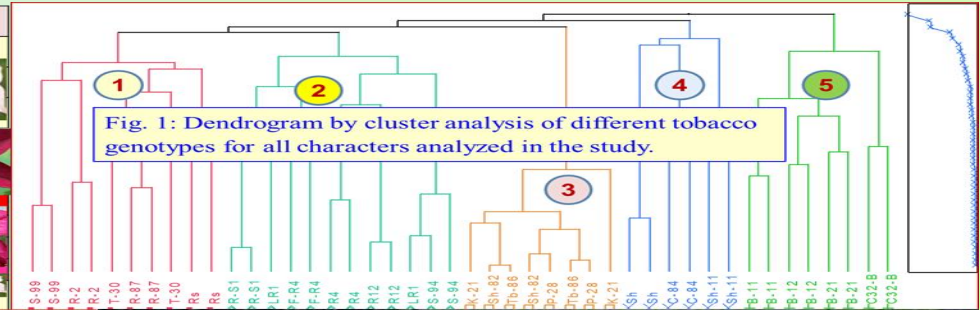
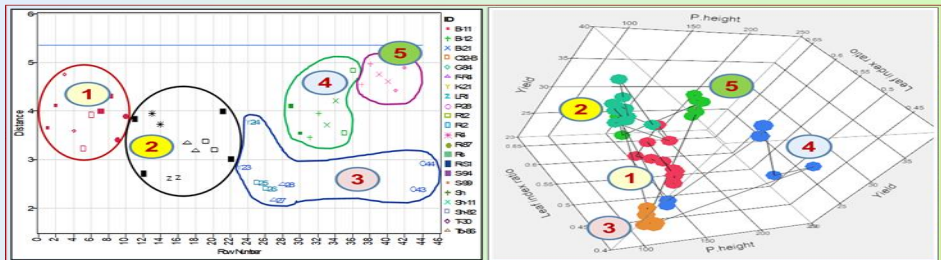










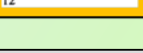
Fig. 1: Dendrogram by cluster analysis of different tobacco genotypes for all characters analyzed in the study.

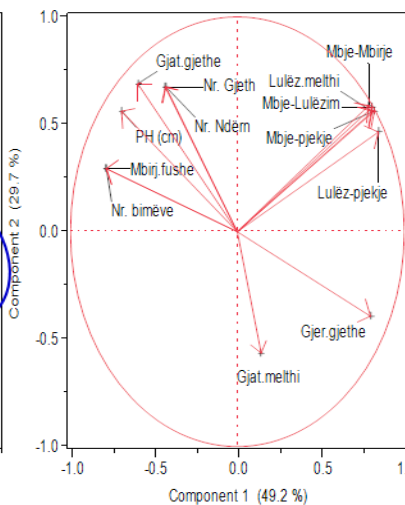
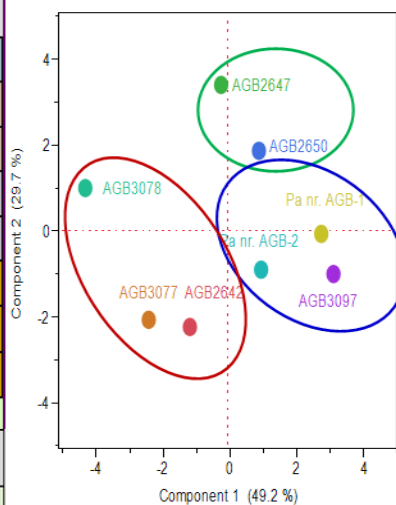
Tobacco genotypes distances according to outlier analysis of Mahalanobis and their views in Scatterplot 3D



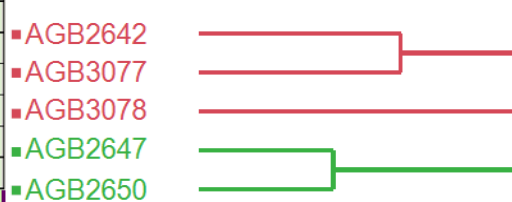
- ✓ Characterization of tobacco germplasm found a very important scientific information on tobacco genetic diversity.
- ✓ Results of the study increase usage value of the tobacco genetic materials conserved in Genebank and they are a concrete contribution for good tobacco information, and an important interest for tobacco germplasm database and for further tobacco breeding programs.

# C&E data. Sorghum 8 +12 acc. (12 QL traits + 33 QN characters) + 22 acc. DNA analysis ..... in Germany.

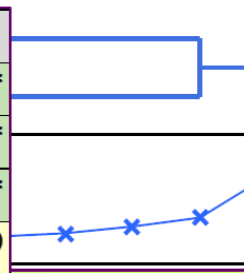
Nr	Nr acc.	Forma melthit	4.2.2 Inflorescence compactness and shape
V1	AGB2642		6 Semi-loose erect primary branches 
V2	AGB2647		9 Compact elliptic 
V3	AGB2650		9 Compact elliptic 
V4	AGB3077		11 Half broom corn 
V5	AGB3078		11 Half broom corn 
V6	AGB3097		12 Broom corn 
V7	Pa nr. AGB-1		12 Broom corn 
V8	Pa nr. AGB-2		12 Broom corn 



NR	Nr acc.	6.2.4 Inflorescence exertion (4.9)	6.1.1 Seedling vigour (4.3)	6.1.3 Senescence (7.7)
V1	AGB2642	3 Well-exserted	5 Intermediate	3 Slightly senescent
V2	AGB2647	3 Well-exserted	3 Low	3 Slightly senescent
V3	AGB2650	3 Well-exserted	4 Low	3 Slightly senescent
V4	AGB3077	4 Peduncle recurved	5 Intermediate	3 Slightly senescent
V5	AGB3078	4 Peduncle recurved	4 Low	5 Intermediate (about half of leaves dead)
V6	AGB3097	4 Peduncle recurved	4 Low	5 Intermediate (about half of leaves dead)
V7	Pa nr. AGB-1	4 Peduncle recurved	5 Intermediate	5 Intermediate (about half of leaves dead)
V8	Pa nr. AGB-2	4 Peduncle recurved	5 Intermediate	3 Slightly senescent



Number	Eigenvalue	Percent	Cum Percent	ChiSquare	DF	Prob>ChiSq
1	6.4025	49.2	49.2	319.781	76.698	<.0001*
2	3.8647	29.7	78.9	233.008	75.169	<.0001*
3	1.8723	14.4	93.381	151.131	69.270	<.0001*
4	0.3998	3.076	96.457	76.809	60.179	0.0729



# C& E & molecular data.

- Sorghum 8 +12 acc. (12 QL traits + 33 QN characters)
- Sorghum 22 acc. DNA analysis ..... in Germany.

## Conclusion sorghum (1<sup>st</sup> year):

### The field trials & statistical analysis:

- assessed **genetic variability** of sorghum germplasm & identified the most important agro-morphological traits with potential for **sustainable the future sorghum breeding programs.**
- **The amount of genetic variability** found suggest that **especially collected** sorghum samples have variability **available to the breeders**, **sufficient** for the creation of new favourable combinations for an improved variety.



B. Gixhari (AUT)



Genetic diversity of some local landraces





# **3. Information System**

## **WEB links**


# 3. Information System: WEB links



The screenshot shows the website of the Faculty of Economics and Agribusiness at the University of Tirana. The header includes the university logo and the faculty name. A navigation bar contains links for 'RRETH UBT', 'APLIKIMET', 'JETA AKADEMIKE', 'KËRKIMI SHKENCOR', 'LIBRARIA', 'SHËRBIME', 'POLITIKAT E PRIVATESISE', and 'LOGIN'. A dropdown menu is open under 'JETA AKADEMIKE', listing: 'Rektorati', 'Fakulteti i Bujqesise dhe Mjedisit', 'Fakulteti i Ekonomise dhe Agrobiznesit', 'Fakulteti i Bioteknologjise dhe Ushqimit', 'Fakulteti i Shkencave Pjore', 'Fakulteti i Mjeksise Veterinare', and 'Sekretaria'. A news item from Oct 01, 2014 is visible on the left.

## Information System:

Other prerequisites for effective utilization of PGR



The screenshot shows the website of the Plant Genetic Resources Center. The header features a large sunflower image and the center's logo. The main heading is 'PLANT GENETIC RESOURCES CENTER' with the tagline 'An Open Window to the Future'. A navigation bar includes links for 'HOME', 'PLANT GENETIC RESOURCES CENTER', 'PLANT GENETIC RESOURCES', 'AGRICULTURE TECHNOLOGY TRANSFER CENTERS', 'PUBLICATIONS', and 'MANAGEMENT'. A search icon is also present. On the left, there is a 'CALENDAR' for March 2015 and a 'MENU' dropdown. The main content area is titled 'INTRODUCTION' and contains text in Albanian: 'Mirësevini në faqen e: Qendres se Resurseve Gjenetike (Bankës Gjenetike) Këtu do të gjeni INFORMACIONE që lidhen me aktivitetet e Bankës Gjenetike.' Below this is a list of services: 'Informacione', 'Publikime', 'Stafi', 'Kontribuesit', 'Rregullore', 'Manuale', 'Koleksionimet', 'Rigjenerimet', and 'Karakterizimet'. On the right, there are sections for 'LANGUAGE' (English, Shqip) and 'ALBANIAN INSTITUTION' (ATTC/QTTB, AUT (Agricultural University of Tirana), MoARDWM (Ministria e Bujqesise, Zhvillimit Rural dhe Administrimit të Ujrave)).

# 3. Information System: WEB links

## INSTITUTI I RESURSEVE GJENETIKE TË BIMËVE



### Institute of Plant Genetic Resources

The Institute of Plant Genetic Resources (IPGR), as a primary unit of Agricultural University of Tirana, is the national institution which coordinates the activities in the field of conservation and management of plant genetic resources (PGR). It is a relatively new institution which had been c

#### RGJBBU Databazë

[Home](#) / RGJBBU Databazë

- **Database i Shqiperise mbi implementimin e Planit të Dytë Global të Veprimit për Resurset Gjenetike Bimore për Bujqësinë dhe Ushqimin** (Për tu lidhur shkruani *Shqiperi* si emer perdoruesi – password – fjalekalim – username)
- **FAO World Information and Early Warning System on PGRFA (WIEWS)**
- **Katalogu EURISCO**
- **Genesys**

Kombëtare.

## Information System: WEB links

**IPGR:** <https://qrgj.org>

**AUT (Agricultural University of Tirana):** <http://www.ubt.edu.al>,

**EURISCO:** <http://eurisco.ipk-gatersleben.de>

**Genesys:** <http://www.genesys-pgr.org>

**SESTO:** <http://sesto.nordgen.org>

**WIEWS:** <http://www.pgrfa.org/WIEWS/>

**FAO:** <http://www.fao.org/wiews/>

# References

- Bari Hodaj, **Belul Gixhari**, Hajri Ismaili. Olive in the story, art and tourist value. QUAESTI, Virtual Multidisciplinary Conference QUAESTI, December, 15. - 19. 2014. The 2nd Virtual Multidisciplinary Conference, **Ecology, Forestry, Earth Science**. 379-383. *University of Zilina* Univerzita 101026 Zilina, Slovak Republic. Online proceedings, ISSN: 1339- 557; ISBN: 978-80-554-0959-7, <http://www.quaesti.com>.
- **Belul Gixhari**, Bari Hodaj, Aljula Gjeloši, Hajri Ismaili. Olive in the story and art in Albania. International Conference “The Adriatic Olive Grove: Risk Prevention, Sustainability, Learning”, 19-20 June, 2014, Corfu, Greece, 297-314. (ISBN: 978-9928-1994-1-6).
- **Belul Gixhari**, Frano Palushaj, Bari Hodaj, Hekuran Vrapı. GEOGRAPHIC DISTRIBUTION AND DIVERSITY ASSESSMENT OF PLANT GENETIC RESOURCES IN SHKODRA REGION. The 2 nd International Conference on Research and Education – “Challenges Toward the Future” (ICRAE2014), 30-31 May 2014, University of Shkodra “Luigj Gurakuqi”, Shkodra, Albania. ICRAE2014, (ISSN: 2308-0825).
- **Gixhari Belul**, Hobdari Valbona, Kadiasi Najada, Faslja Ndoc. GEOGRAPHIC DISTRIBUTION AND SPATIAL GAPS ASSESSMENT IN EX SITU COLLECTION OF *Origanum vulgare* L. STORED IN ALBANIAN GENE BANK. *Original scientific paper*. Proceedings of the 8th CMAPSEEC: (8 CMAPSEEC, Conference on Medicinal and Aromatic Plants of Southeast European Countries). 2014, 59- 66. ISBN: 978-99956-10-66-1.
- **Belul GIXHARI**, Michaela PAVELKOVÁ, Hairı ISMAILI, Hekuran VRAPı, Alban JAUPI and Petr SMÝKAL. Genetic Diversity of Albanian Pea (*Pisum sativum* L.) Landraces Assessed by Morphological Traits and Molecular Markers. Czech J. Genet. Plant Breed., 50, **2014** (2): 177–184 (IF. 0.485). ISSN 1212-1975 (Print), ISSN 1805-9325 (On-line), Czech Academy of Agricultural Sciences.
- **Gixhari Belul**, Hobdari Valbona, Kadiasi Najada, Faslja Ndoc, İbralıu Alban. GEOGRAPHIC DISTRIBUTION AND DIVERSITY ASSESSMENT IN EX SITU COLLECTION OF ALBANIAN MEDICINAL PLANTS. *Original scientific paper*. Proceedings of the 8th CMAPSEEC: (8 CMAPSEEC, Conference on Medicinal and Aromatic Plants of Southeast European Countries). 2014, 51- 58. ISBN: 978-99956-10-66-1.
- **Belul Gixhari**; Hairı Ismaili; Hekuran Vrapı; Fetah Elezi; Sonia Dias; Halit Sulovari. Geographic distribution and diversity of fruit tree species in Albania. *International Journal of Ecosystems and Ecology Sciences (IJEES)*, **2012**, Vol. 2 (4), 355-360 (ISSN: 2224-4980).
- **Belul Gixhari**, Hekuran Vrapı, Adriatik Çakallı, Harallamb Paçe. DIVERSITY OF LOCAL LANDRACES COLLECTED DURING 2009-2010 PERIOD AND THEIR REPRESENTATIVENESS IN ALBANIAN GENE BANK. *International Journal of Ecosystems and Ecology Sciences (IJEES)* Vol. 6 (4): 551-558 (2016). ISSN: 2224-4980.

# References

- **Belul Gixhari**, Hairi Ismaili, Hekuran Vrapı, Bari Hodaj, Valbona Hobdari, Raimonda Sevo. Genetic diversity evaluation of grass pea genotypes (*Lathyrus sativum*) using qualitative morphological traits. Simposium i **IX<sup>te</sup>** Ndërkombëtar Biodiversiteti- Ruajtja dhe përdorimi i qëndrueshëm faktor kyç për zhvillimin e qëndrueshëm rural, Tiranë, 27 Nentor/ **IX<sup>th</sup>** International Symposium - Biodiversity Conservation and Sustainable use for Rural Development. Tirana, November 27, **2013**, **96-99**. Proceeding Book, (ISBN: 978-9928-4070-9-2).
- **Belul Gixhari**; Valbona Hobdari; Fetah Elezi; Majlinda Belegu; Suzana Papadhopulli. GENETIC DIVERSITY ASSESMENT OF PEA (*PISUM SATIVUM* L.) GERMPLASM BASED ON QUANTITATIVE MORPHOLOGICAL AND QUALITATIVE TRAITS. . 3<sup>rd</sup> International Conference of Ecosystems (ICE), Tirana, Albania, May 31 - June 5, **2013**, Proceeding Book ICE\_2013 Vol. 3, p 997-1003. (ISBN: 978-9928-4068-7-3).
- **B. Gixhari**, I. Çiçi, R. Sevo. Geographic Diversity of Currently Fruit Tree Species in Albania. 2<sup>nd</sup> International Conference of Ecosystems (ICE), Tirana, Albania, **June 1-4, 2012**. International Journal of Ecosystems (ICE-2012), 255-260, Proceeding Book (ISBN 978-9928-4068-2-8), Agricultural University of Tirana, Tirana, Albania
- **Gixhari, B.**, Elezi, F., Dias, S., Vrapı, H., Hobdari, V., Bode, D. Diversity of Albanian plant genetic resources inventory in EURISCO. VIII<sup>th</sup> International Symposium, BIODIVERSITY, Conservation and Sustainable Use for Rural Development, November 21, **2012**, 193-196. BLEKALB Foundation. (ISBN: 9789928407092).
- HAIRI ISMAILI, **BELUL GIXHARI**, BENARD RUCI. Assessment of the olive territory through bio-morphological and geographical analysis. *Albanian j. agric. sci.* **2013**; 12 (4): 715-719. *Agricultural University of Tirana (Open Access)* (ISSN: 2218-2020).
- **Belul Gixhari**, and Hekuran Vrapı. Evaluation of Genetic Diversity of Grass Pea (*Lathyrus sativum*) Genotypes by Morphological Qualitative Traits. IJGHC, September -2013-November **2013**; Vol.2, No.4, 1050-1056. (E-ISSN: 2278-3229) International Journal of Green and Herbal Chemistry. (Available online at [www.ijghc.com](http://www.ijghc.com)).