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diversity
MDPI

Ampelometric and ampelographic characterization of leaves of indigenous *"Vitis vinifera ssp. Vinifera"* in the North of Morocco

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Royaume du Maroc
Ministère de l'Education Nationale, de la Formation Professionnelle, de l'Enseignement Supérieur et de la Recherche Scientifique
Département de l'Enseignement Supérieur et de la Recherche Scientifique

Equipe Bio Agrodiversité
Laboratoire Botanique Appliquée

INTRODUCTION

The vine has always occupied an important place in the traditional Mediterranean landscape, by it is presence in two forms: wild and cultivated

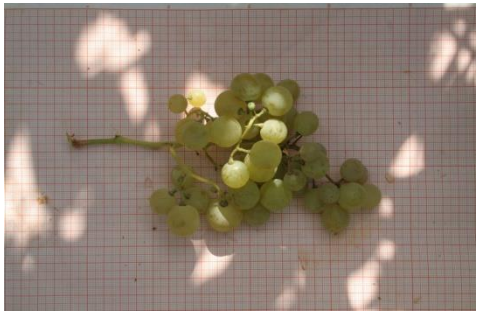
INTRODUCTION

The introduction of new grape varieties has generated a genetic erosion of the viticultural heritage.

INTRODUCTION

Ignorance of our vine heritage and the lack of a catalog described and behavior of these grape varieties

Recognize the local phylogenetic heritage, and the plant genetic wealth that the country conceals.



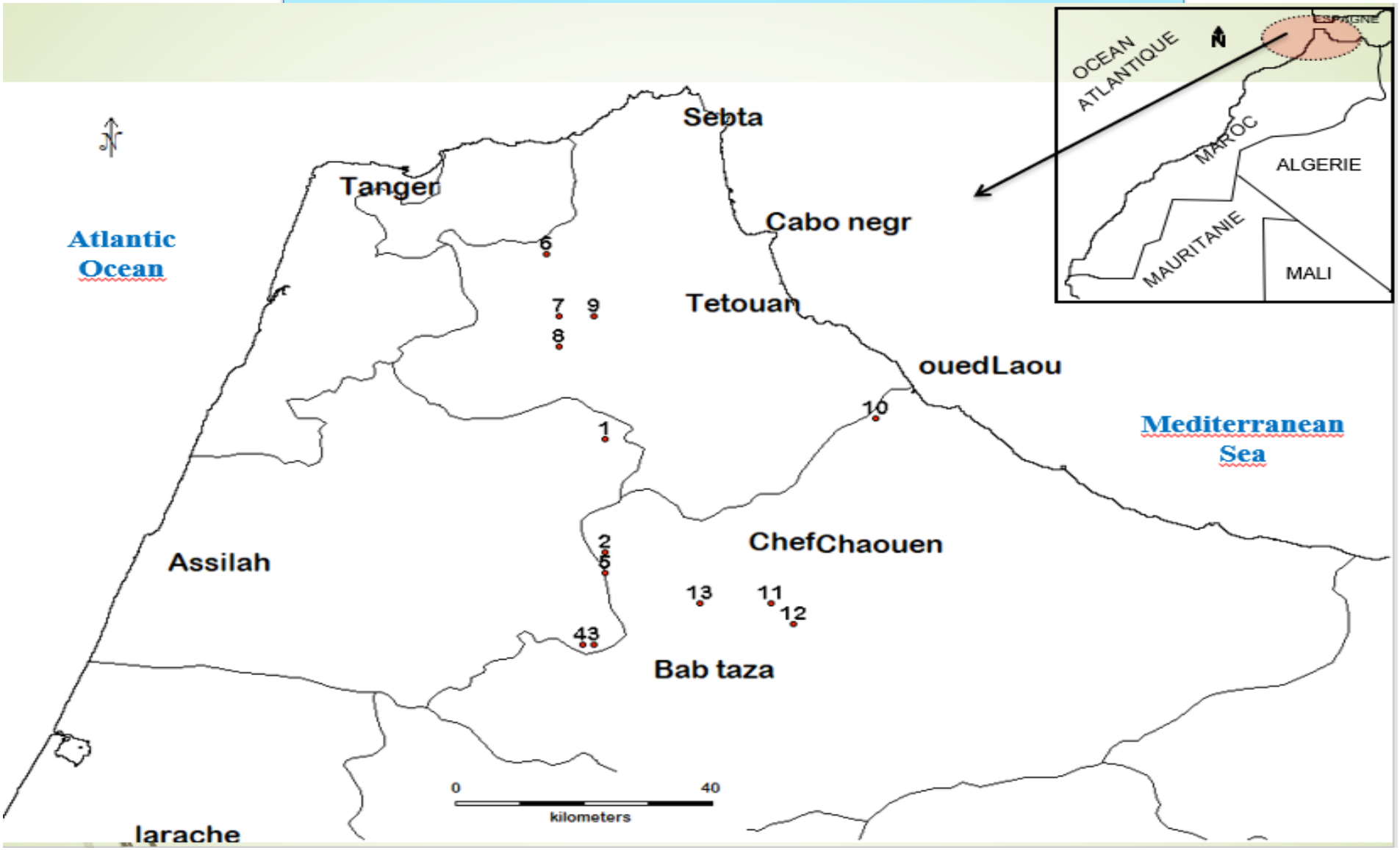
INTRODUCTION

Characterize native grape varieties, facilitate their recognition and contribute to the conservation and protection of all this varietal diversity.

Study of biodiversity in the Rif Mountain's traditional agroecosystems

Ampelometric and ampelographic approach

MATERIAL AND METHODS



Location map of the surveyeds sites.

MATERIAL AND METHODS

Collection of leaf varieties

MATERIAL AND METHODS

Ainab byed

Babour Hmara

Bzul laawda

Chouikhi

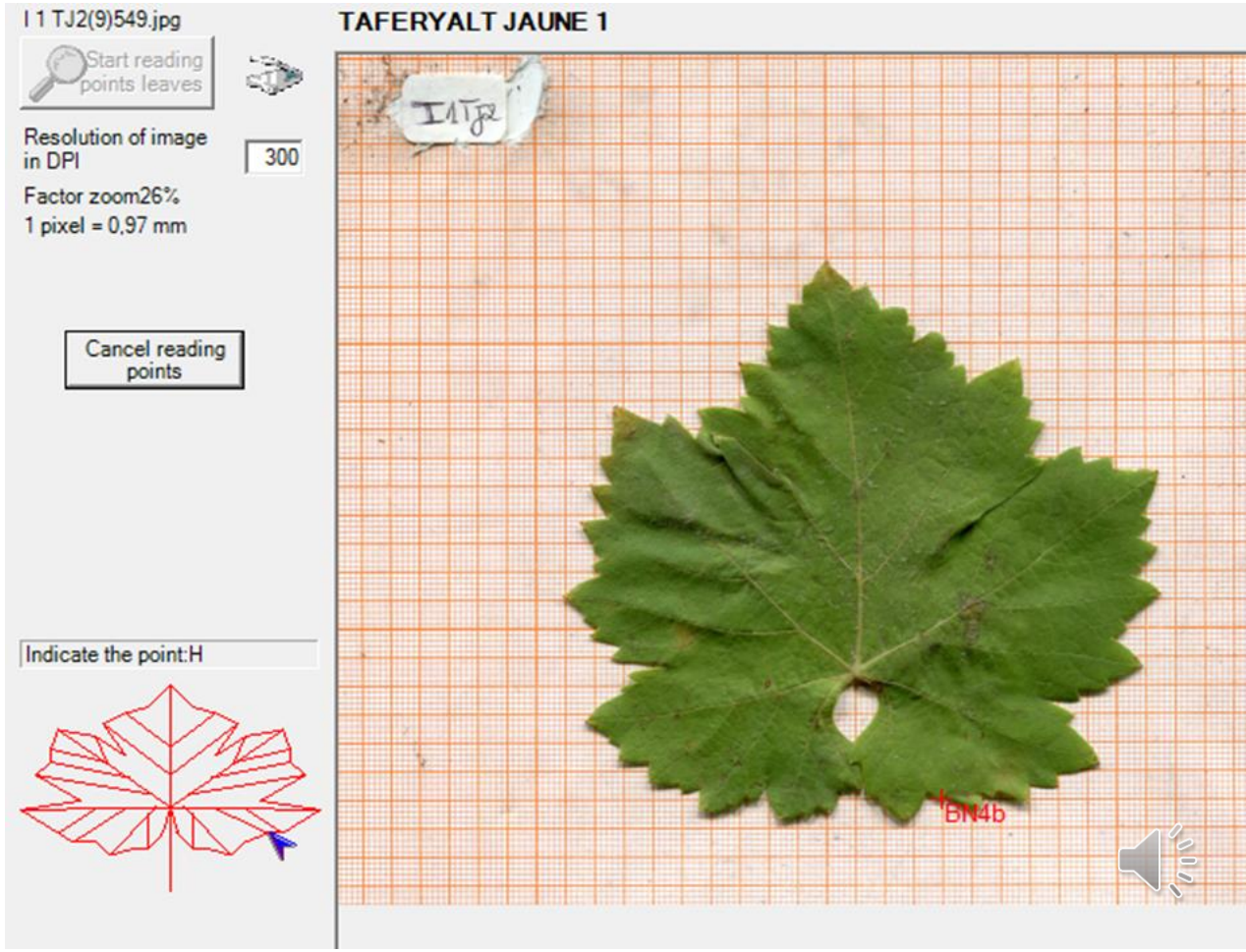
Fekkase

Hemar Bouammar

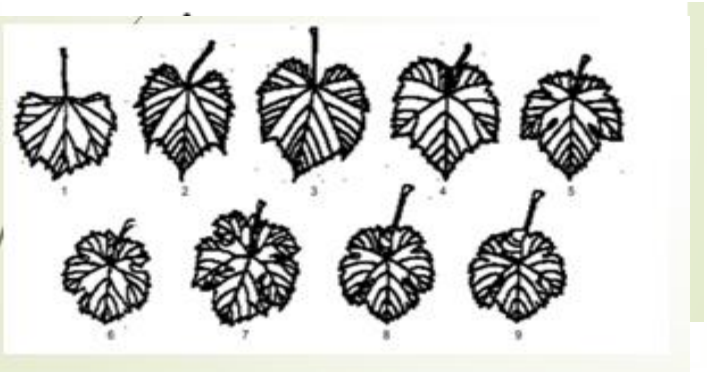
Sbiae lebnat

Taferyalt jaune

MATERIAL AND METHODS



MATERIAL AND METHODS



Visual OIV codes

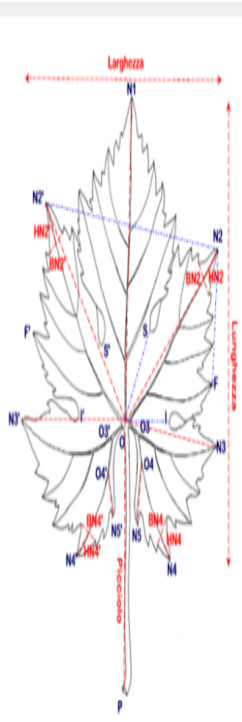
Shape of blade (OIV067)	< > Suggest
Number of lobes (OIV068)	< >
Up. side: anthocyanin coloration of the main veins (OIV070)	< >
Up. side: anthocyanin coloration of the main veins (GENRES070)	< >
Goffering of blade (OIV072)	< >
Profil (OIV074)	< >
Blistering of upper side (OIV075)	< >
Shape of teeth (OIV076)	< >
Shape of teeth (GENRES076)	< >
Degree of petiole sinus opening (OIV079)	< >
Degree of petiole sinus opening (GENRES079)	< >
Shape of base of petiole sinus (OIV080)	< >
Shape of base of petiole sinus (GENRES080)	< >
OIV081-1	
It is present on the right margin of the petiole sinus a tooth?	No
It is present on the left margin of the petiole sinus a tooth?	No
Petiole sinus limited by veins (OIV081-2)	< >
OIV083-2	
They are present on the base of the upper leaf sinuses of the right side of the teeth?	No
They are present on the base of the upper leaf sinuses of the left side of the teeth?	No
Lower side: density of prostrate hairs between the main veins (OIV0	< >
Lower side: density of erect hairs on the main veins (OIV087)	< >
OIV 616	
Number of teeth between the tooth tip of N2 and the tooth tip of the first secondary vein of N2 including the limits: left-hand	0
Number of teeth between the tooth tip of N2 and the tooth tip of the first secondary vein of N2 including the limits: right-hand	0

MATERIAL AND METHODS

Distances

Angles

Ratio



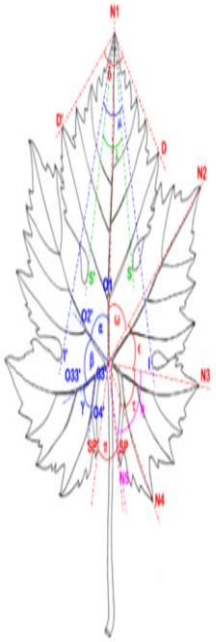
Select the variety: 4: CHOUIKHI2

Order by: Analysis / Name

Distances | Angles | Ratio | Codes OIV | Synthetic data

Distances

	Length	Width	Leng. + pedu	O-P	O-N1	N2-N2'	N3-N3
1	126,9	113	137,1	39,1	98	94	106
2	149,7	120	162	53,7	108,2	114,9	105
3	143,2	137,3	152,7	58,9	93,7	130	111
4	164,7	172,7	173,2	61,8	111,5	173,3	109
5	171,8	187,7	178,8	65,6	113,3	188,8	99
6	173,3	177,3	185,6	66	119,6	163,9	138
7	166	140,5	160,5	49,4	111,1	125,8	142
8	115,1	123,4	121,1	38,2	82,9	110,3	107
9	105,7	101	112,4	37,3	75,1	92,6	78
10	98,5	111,1	98	31,3	66,8	104,6	76
11	98,1	103,7	100,3	37,2	63,1	91,6	
12	137,5	157,3	148,9	56,6	92,2	153,6	110
13	125,6	128,2	132,8	48,2	84,6	121	102
14	118,9	122,4	122	39,9	82,2	114,1	11
15	117,3	126,7	121,3	41,8	79,5	112,1	100
16	122,7	133,7	136,3	54,2	82	124,6	96



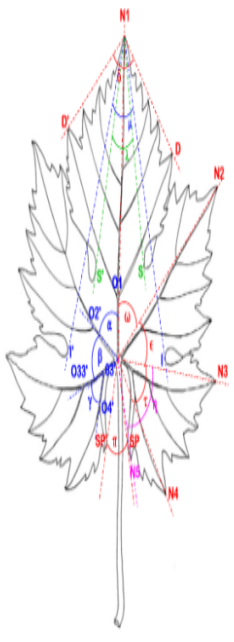
Select the variety: 4: CHOUIKHI2

Order by: Analysis / Name

Distances | Angles | Ratio | Codes OIV | Synthetic data

Angles

	α	α'	β	β'	γ	γ'	ω	ω'	
1	33,7	151	57,4	42,3	94,6	69,9	32,8	49,7	
2	51,1	61,3	43,3	24,5	42,6	66,1	45,8	51,8	
3	66	63,7	57,9	22,6	46,5	79,7	54,2	52,3	
4	73,4	63	62,4	30,1	35,2	77,2	59,7	63,5	
5	70,7	77,8	64,9	58,4	39,5	58,6	53,3	81,2	
6	70,5	73,9	48,6	31,3	33,8	153,3	60,2	50,4	
7	70,2	51,9	69	30	70,8	73	59,6	34,8	
8	55,4	61,4	49,7	28,6	80,7	56,4	37,2	55,2	
9	57,1	63,5	63	23,6	54	105,8	47,9	48,4	
10	65,3	64,1	99,4	8,1	31,2	94,2	60	48,4	
11	71,3	69,4	58,5	21,1	91,4	89,2	51,8	49,6	
12	62,9	76,9	47,5	51,8	14	50,2	65,7	56,8	
13	60,4	61,9	59,4	27,1	82,8	59,8	51,5	49,8	
14	67,3	59,9	55,6	6,3	62,9	61,8	51,9	49,7	
15	67,2	66,1	51,5	12,1	70,8	63	47,6	50,3	
16	67	74,5	61,2	31,6	66,9	53	43,3	61,2	



Select the variety: 4: CHOUIKHI2

Order by: Analysis / Name

Distances | Angles | Ratio | Codes OIV | Synthetic data

Ratio

	Length x Width	Length / Width	OP/ON1	OS/ON2	OS/ON2'	OI
1	14338,3	1,123	0,399	0,846	0,584	
2	17969,7	1,248	0,496	0,452	0,447	
3	19667	1,043	0,629	0,435	0,503	
4	28441,5	0,954	0,554	0,378	0,381	
5	32241	0,915	0,579	0,608	0,559	
6	30723,6	0,977	0,552	0,632	0,689	
7	23323,7	1,182	0,444	0,516	0,422	
8	14200,5	0,933	0,461	0,496	0,386	
9	10679,5	1,047	0,496	0,558	0,508	
10	10939,3	0,886	0,469	0,482	0,506	
11	10175	0,946	0,589	0,389	0,551	
12	21636,5	0,874	0,614	0,464	0,369	
13	16099,1	0,98	0,57	0,529	0,421	
14	14549,7	0,971	0,485	0,467	0,518	
15	14862,9	0,926	0,526	0,424	0,552	
16	16408,2	0,918	0,661	0,5	0,475	

Results and discussion

Our slide is composed of:

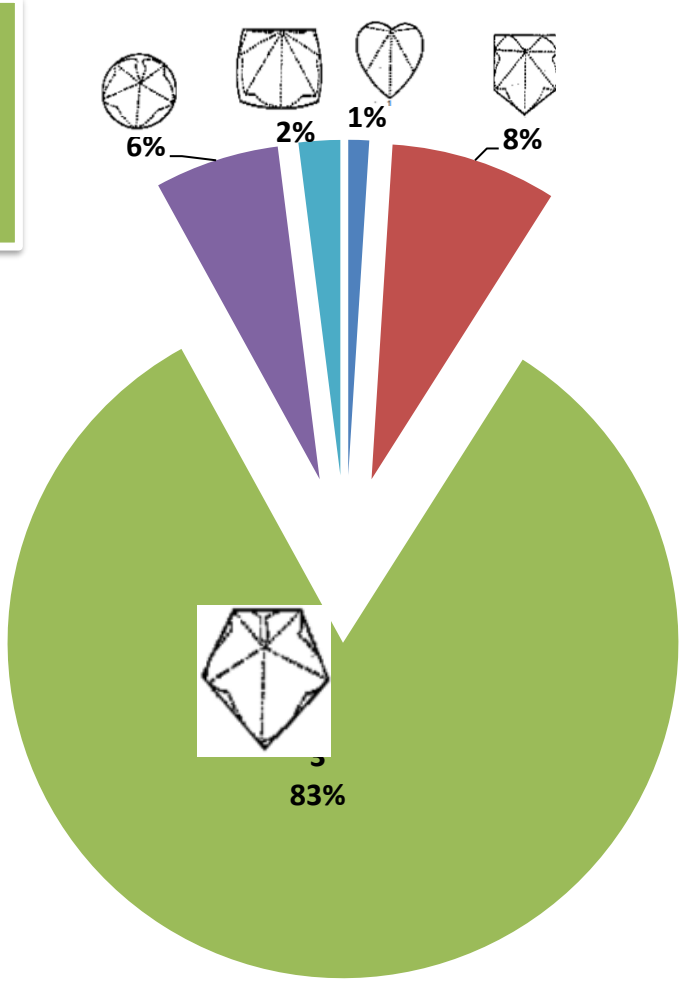
27 traditionals varieties

1617 leaves

Results and discussion

Qualitative characterization of the adult leaf

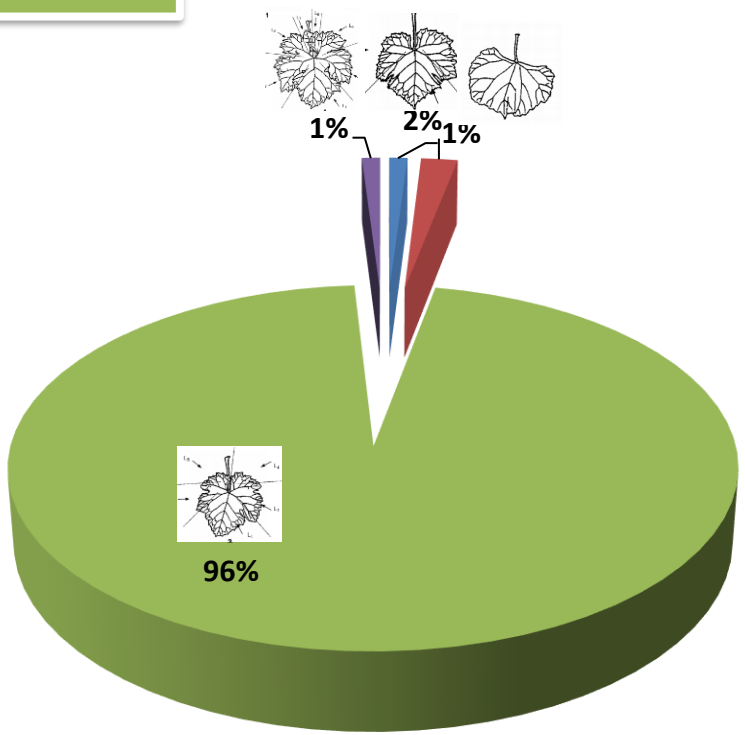
Shape of blade



Results and discussion

Qualitative characterization of the adult leaf

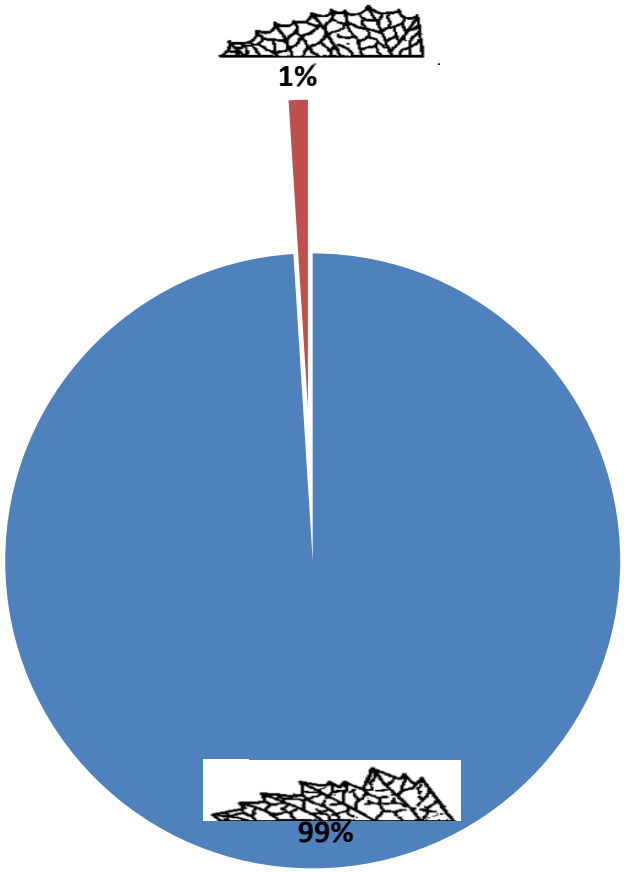
Number of lobes



Results and discussion

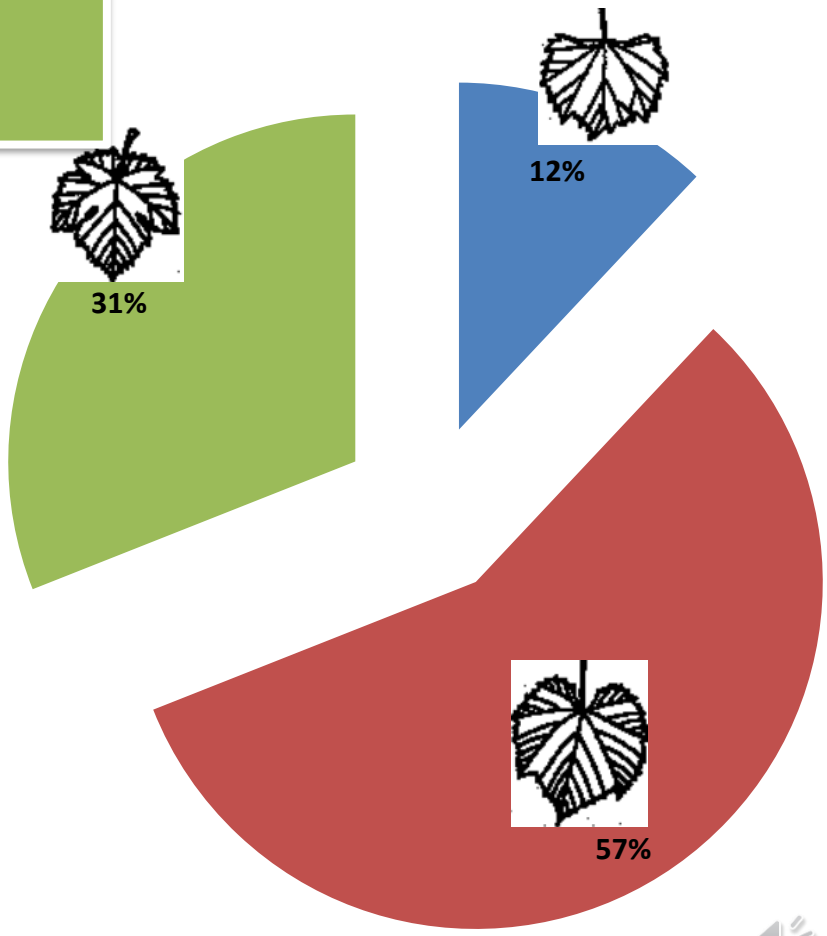
Qualitative characterization of the adult leaf

Shape of teeth



Results and discussion

Qualitative characterization of the adult leaf

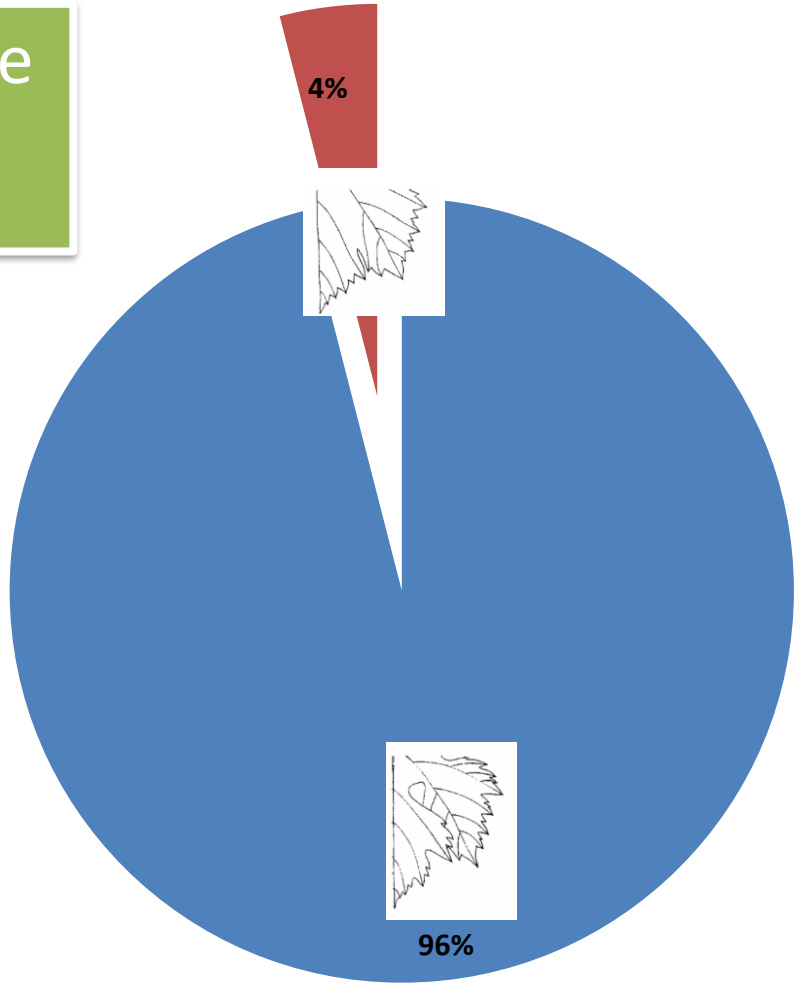


Degree of opening of petiole sinus

Results and discussion

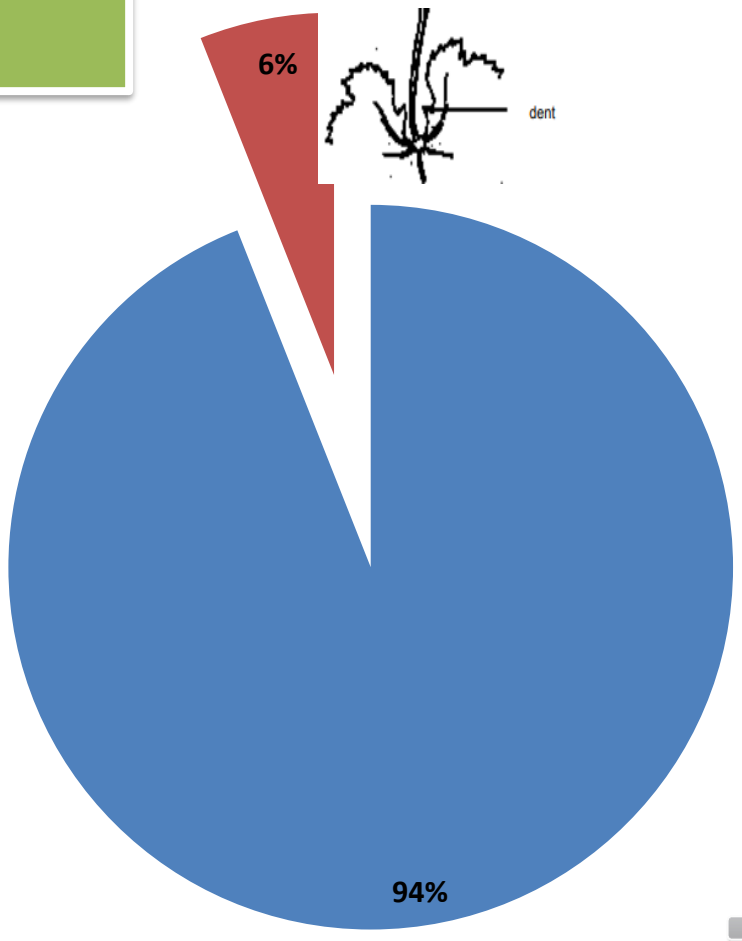
Qualitative characterization of the adult leaf

Shape of Sinus



Results and discussion

Qualitative characterization of the adult leaf



Teeth in the petiole sinus

Results and discussion

Quantitative characterization of the adult leaf (ANOVA)

Variable	Moyenne	Ecart-type	F de Fisher	Pr > F
HD1	0.336	1.184	185.648	< 0.0001
BD1	4.811	4.349	44.433	< 0.0001
BD	4.964	4.587	34.627	< 0.0001
HBD1	0.029	0.047	16.126	< 0.0001
RS1	0.608	0.123	10.574	< 0.0001
RI	0.766	0.134	9.696	< 0.0001
RS	0.58	0.14	9.316	< 0.0001
PI	82.841	33.248	9.061	< 0.0001
BN2	18.958	7.147	8.962	< 0.0001
Area	8209.887	4341.814	8.043	< 0.0001
MU	50.486	9.557	7.622	< 0.0001
RI1	0.719	0.121	7.612	< 0.0001
LAM	50.947	18.209	7.578	< 0.0001
LUXLA	11184.898	5869.877	7.424	< 0.0001
N2N21	93.543	25.864	7.393	< 0.0001
LA	104.791	27.324	7.092	< 0.0001
LU	99.816	28.118	6.886	< 0.0001
OP	33.74	12.2	6.79	< 0.0001
ON41	32.852	10.653	6.595	< 0.0001
LUPIC	108.343	29.267	6.206	< 0.0001
O41N51	12.498	5.99	6.069	< 0.0001
O31N41	27.763	9.163	5.933	< 0.0001
FN2	35.467	12.386	5.746	< 0.0001
ON21	66.007	17.748	5.71	< 0.0001
O4N5	12.171	5.263	5.684	< 0.0001
BN41	13.01	6.162	5.615	< 0.0001
BN21	18.03	6.199	5.574	< 0.0001
ON2	66.093	17.513	5.463	< 0.0001
O3N4	27.587	9.346	5.344	< 0.0001
HBD	0.014	0.033	5.262	< 0.0001
N4N41	38.835	16.83	5.242	< 0.0001
ON4	33.099	10.54	5.19	< 0.0001
ON31	47.483	13.661	5.171	< 0.0001
OS	37.753	12.116	5.124	< 0.0001
N3N31	92.181	26.46	5.067	< 0.0001
FN21	34.471	12.309	5.047	< 0.0001
ON1	74.599	20.925	5.042	< 0.0001
OI	35.626	10.534	4.973	< 0.0001
BN4	12.614	5.319	4.97	< 0.0001
OS1	39.576	12.028	4.969	< 0.0001
OI1	33.677	10.14	4.895	< 0.0001

Variable	Moyenne	Ecart-type	F de Fisher	Pr > F
ON3	47.408	13.886	4.813	< 0.0001
HN2	8.071	4.879	4.64	< 0.0001
ALBEGA	161.832	31.573	4.232	< 0.0001
ALBE	106.399	21.5	4.131	< 0.0001
TA	43.988	10.043	4.066	< 0.0001
ALBEOSOI	0.028	0.011	4.041	< 0.0001
SPSP1	-12.98	5.613	3.942	< 0.0001
ET	52.834	9.57	3.887	< 0.0001
ANGA	60.82	14.343	3.878	< 0.0001
TA1	45.357	10.732	3.826	< 0.0001
AL	53.552	12.672	3.715	< 0.0001
HBN21	0.467	0.203	3.701	< 0.0001
ET1	52.308	9.588	3.455	< 0.0001
ANGA1	62.236	15.83	3.319	< 0.0001
HN21	8.264	4.075	3.25	< 0.0001
LULA	0.951	0.086	3.162	< 0.0001
HD	0.088	0.268	3.032	< 0.0001
AL1	55.922	19.041	2.995	< 0.0001
GA	55.432	21.377	2.981	< 0.0001
ALBEOSOI1	0.021	0.01	2.935	< 0.0001
GA1	51.828	20.446	2.909	< 0.0001
OO3	7.669	4.337	2.815	< 0.0001
OO31	6.847	3.772	2.779	< 0.0001
ALBEGA1	130.583	36.104	2.707	< 0.0001
OM	43.116	12.455	2.53	< 0.0001
OM1	48.58	13.33	2.409	< 0.0001
BE	52.847	16.917	2.38	< 0.0001
ALBE1	78.783	28.934	2.121	< 0.0001
DE	99.79	24.686	2.059	< 0.0001
HBN4	0.387	0.329	1.659	0.001
HBN2	0.43	0.283	1.503	0.009
BE1	22.861	19.874	1.336	0.047
R21	0.907	0.489	1.087	0.305
R51	0.175	0.318	1.063	0.35
R41	0.385	0.489	0.98	0.519
R5	0.171	0.284	0.965	0.553
R2	0.925	1.137	0.909	0.671
R31	0.671	1.135	0.899	0.691
RP	0.509	1.87	0.895	0.7
R4	0.385	0.537	0.895	0.699
R3	0.681	1.626	0.876	0.737
HN4	4.786	4.645	0.832	0.615
HN41	4.77	8.59	0.82	0.833
HBN41	0.389	0.892	0.65	0.982

Results and discussion

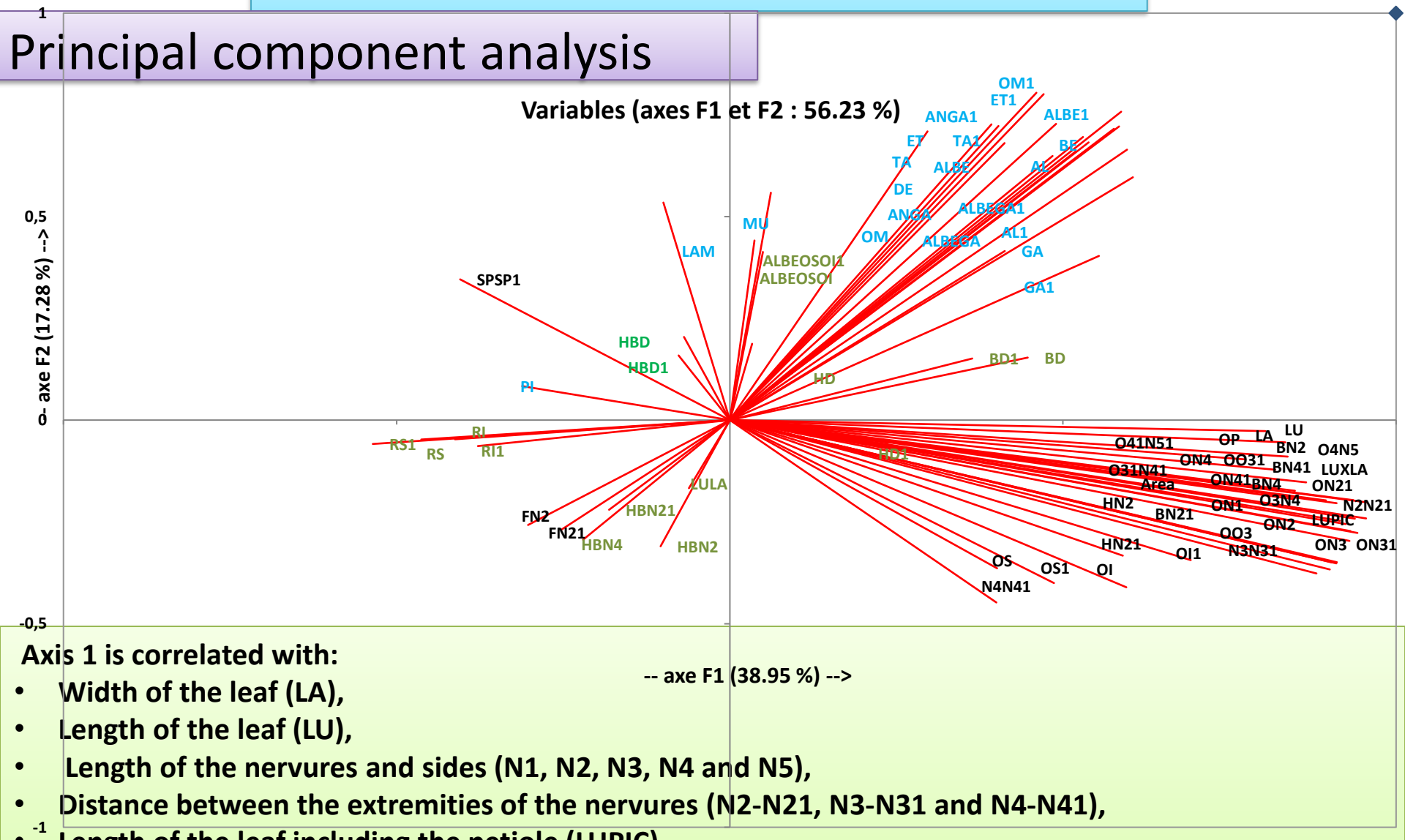
Analysis of the variance

Characters with very high F :

- Size and base of the teeth (HD, BD),
- Shape of teeth (HBD1),
- Petiole opening angle (PI)
- Surface (Area)

Results and discussion

Principal component analysis

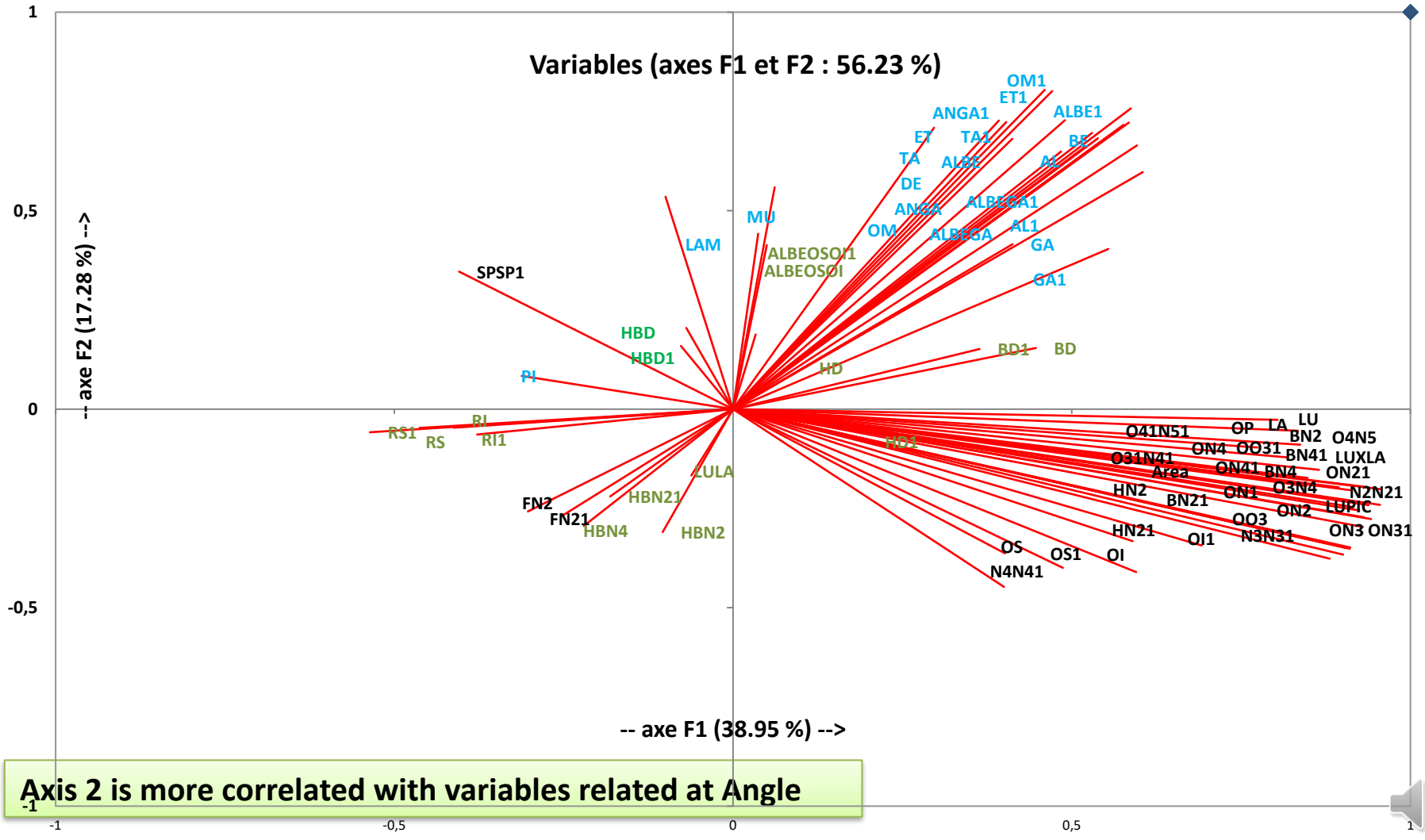


Axis 1 is correlated with:

- **Width of the leaf (LA),**
- **Length of the leaf (LU),**
- **Length of the nervures and sides (N1, N2, N3, N4 and N5),**
- **Distance between the extremities of the nervures (N2-N21, N3-N31 and N4-N41),**
- **Length of the leaf including the petiole (LUPIC),**
- **Area (Area)**
- **Length of the petiole (OP).**

Results and discussion

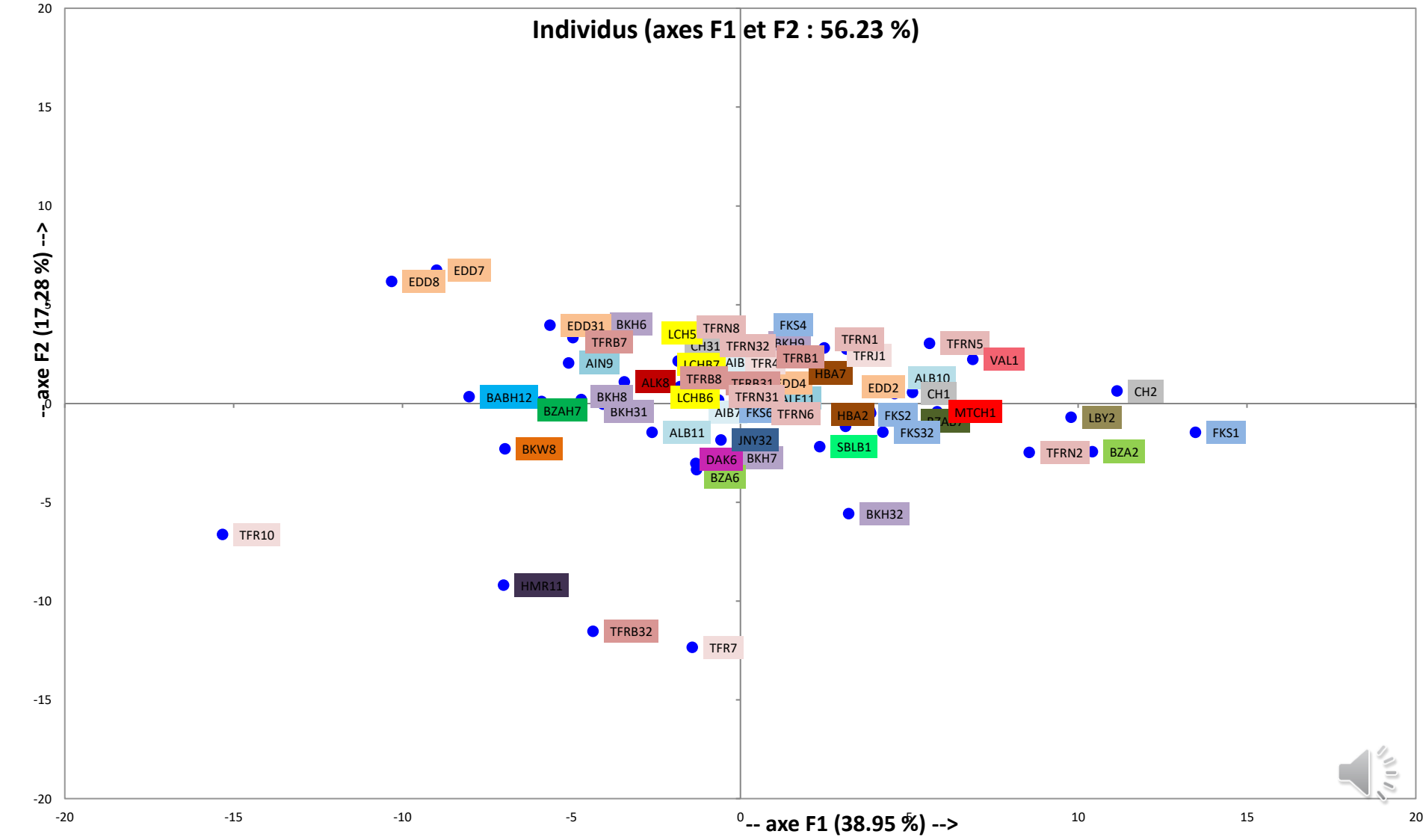
Principal component analysis



Axis 2 is more correlated with variables related at Angle

Results and discussion

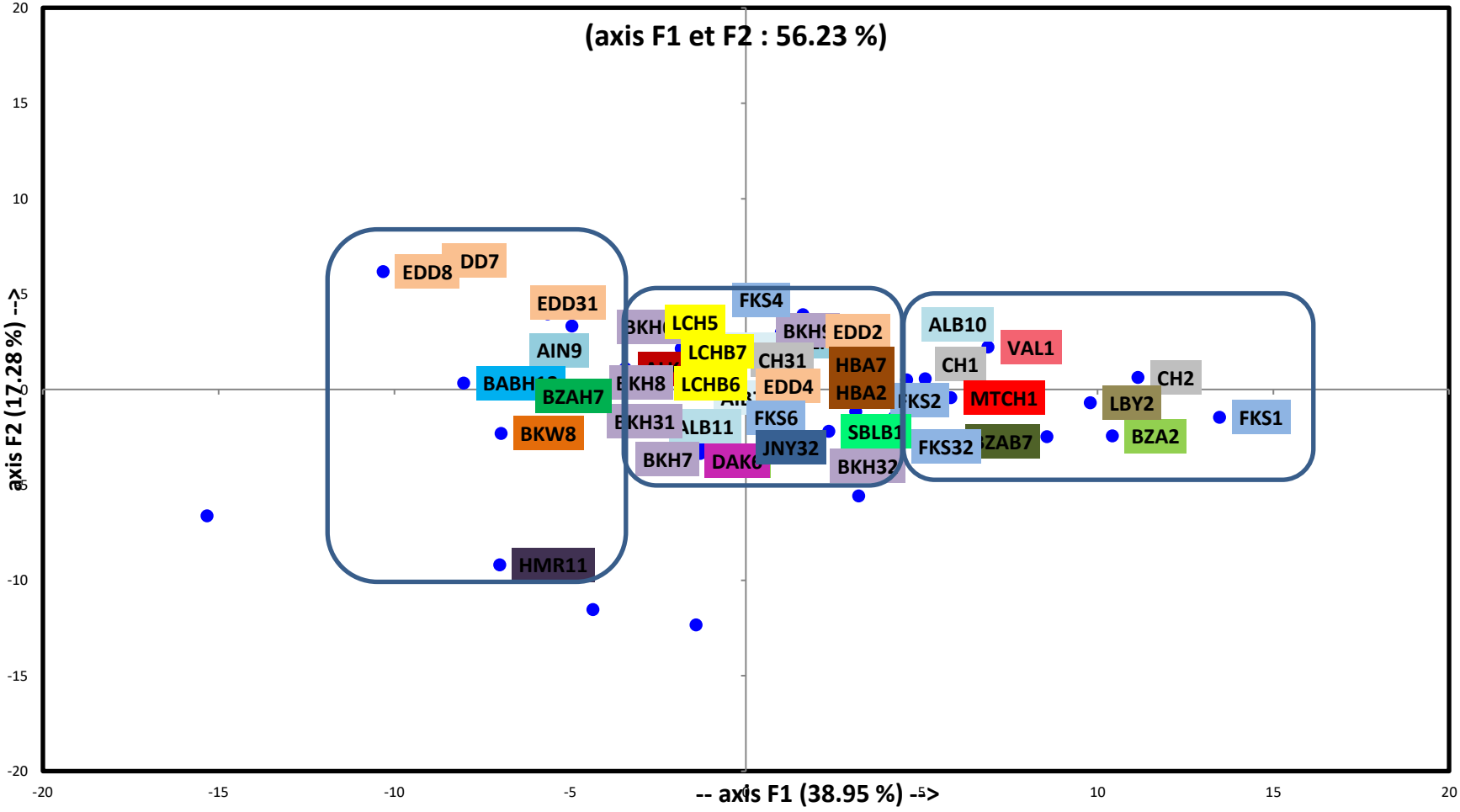
Principal component analysis



Results and discussion

Principal component analysis

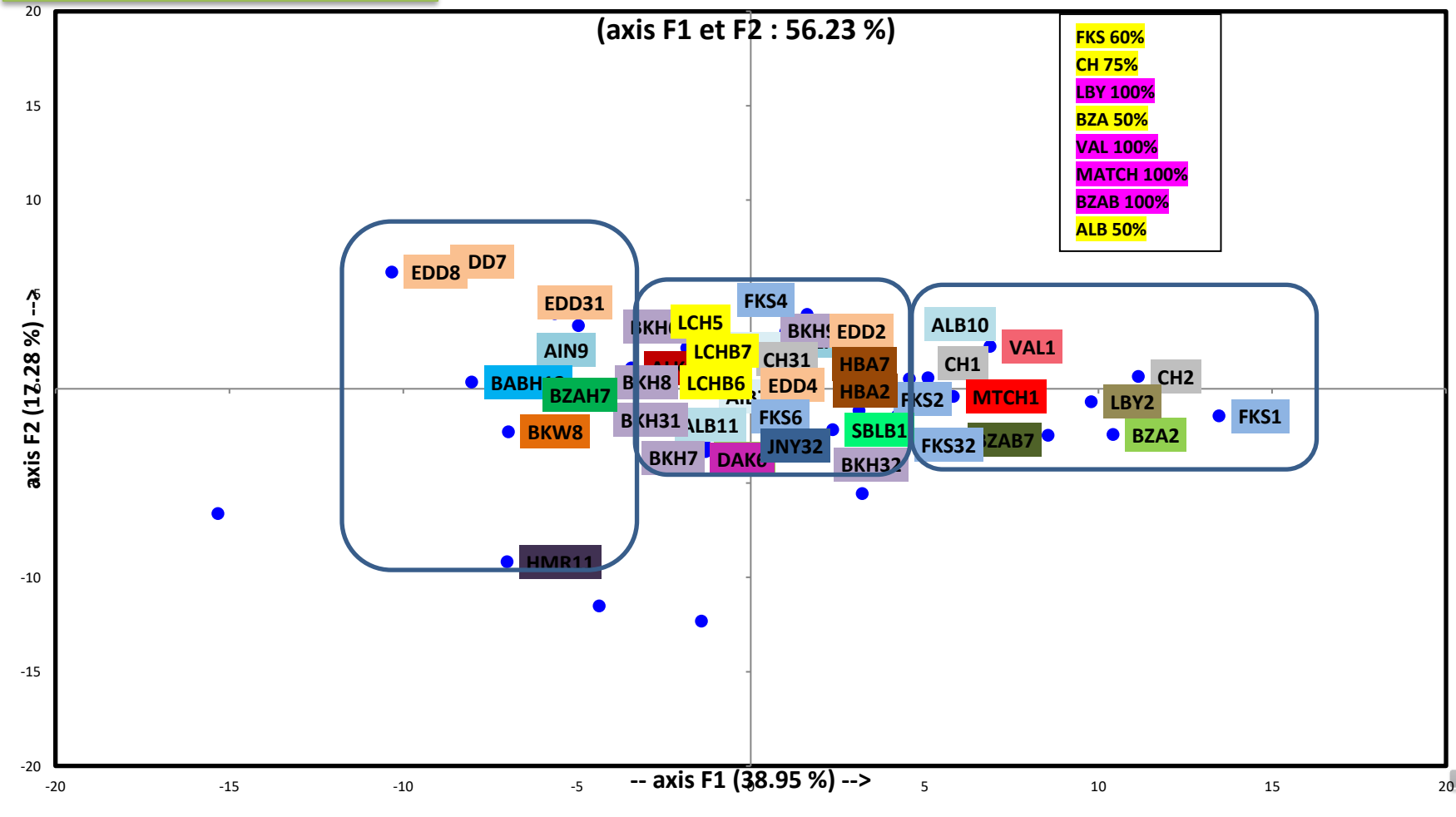
Base without taferyalet.



Results and discussion

Principal component analysis

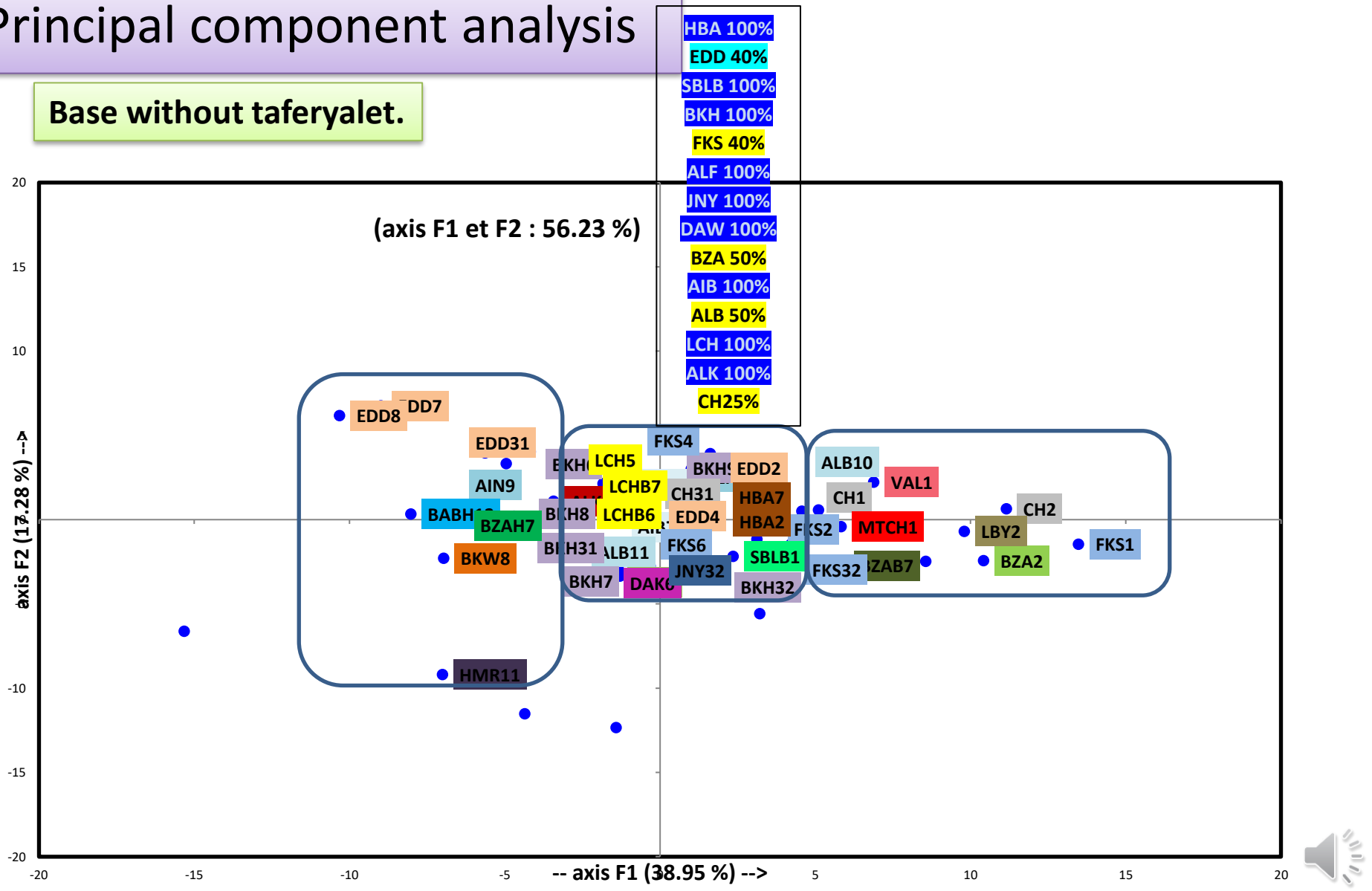
Base without taferyalet.



Results and discussion

Principal component analysis

Base without taferyalet.



Results and discussion

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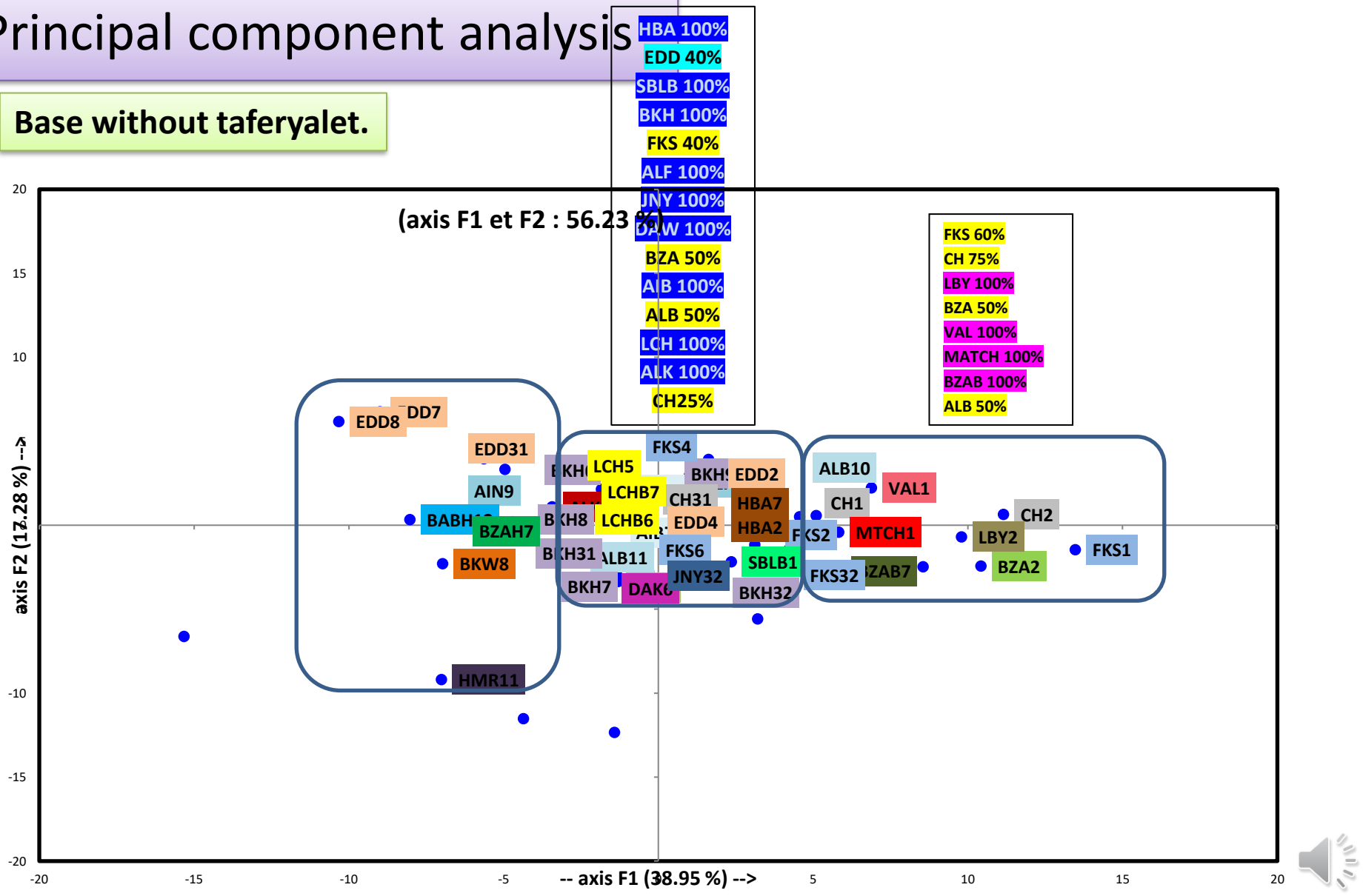
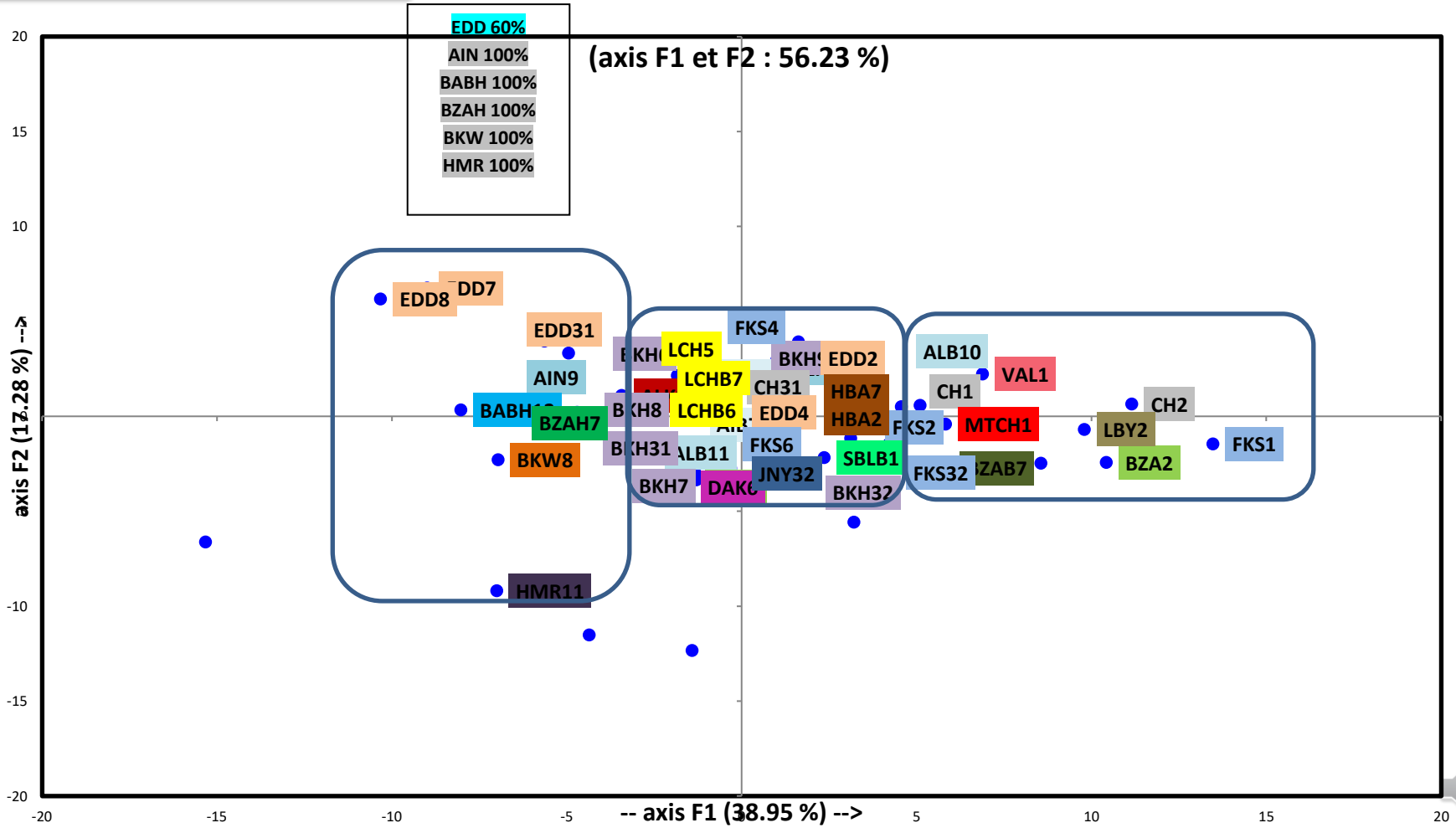
Base without taferyalet.



Results and discussion

Principal component analysis

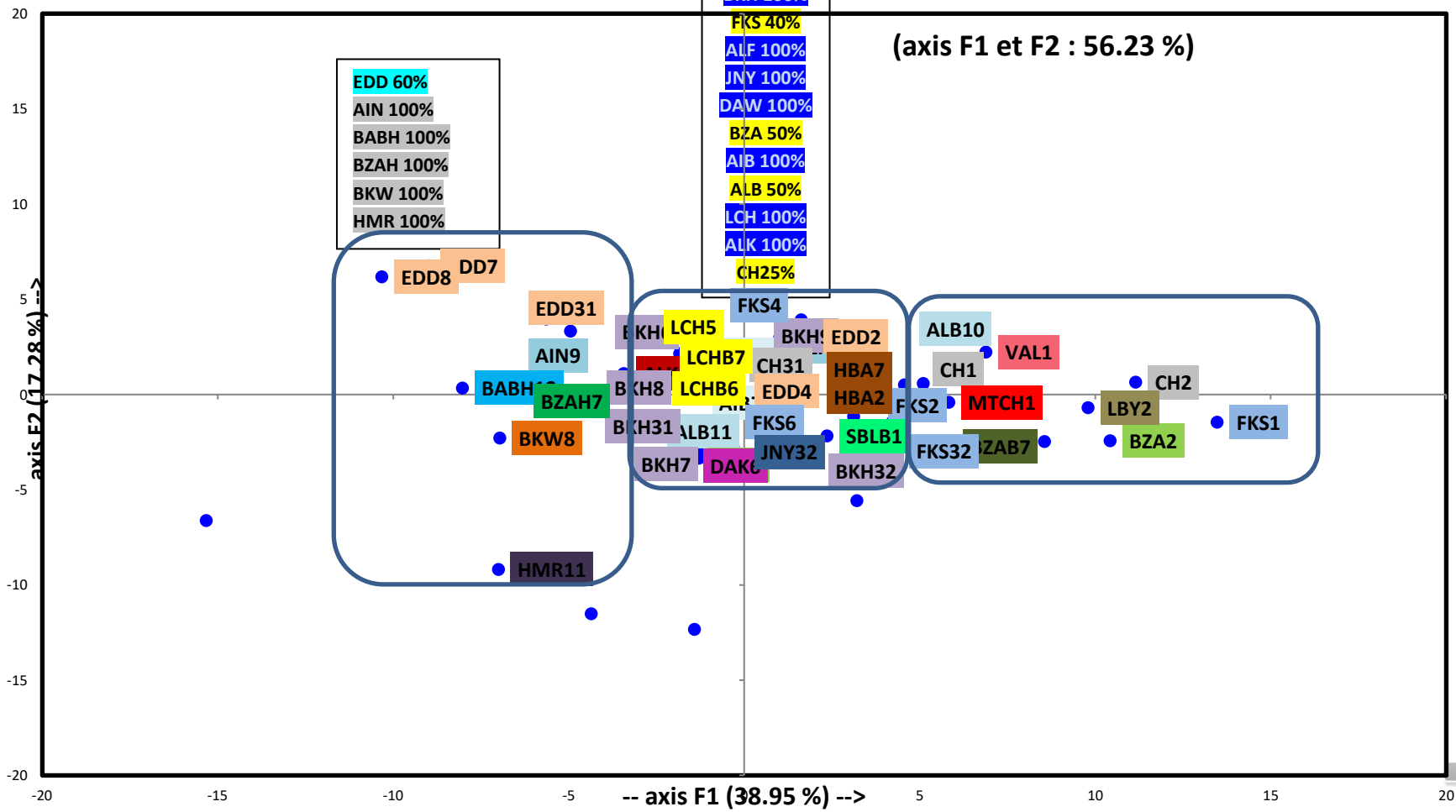
Base without taferyalet.



Results and discussion

Principal component analysis

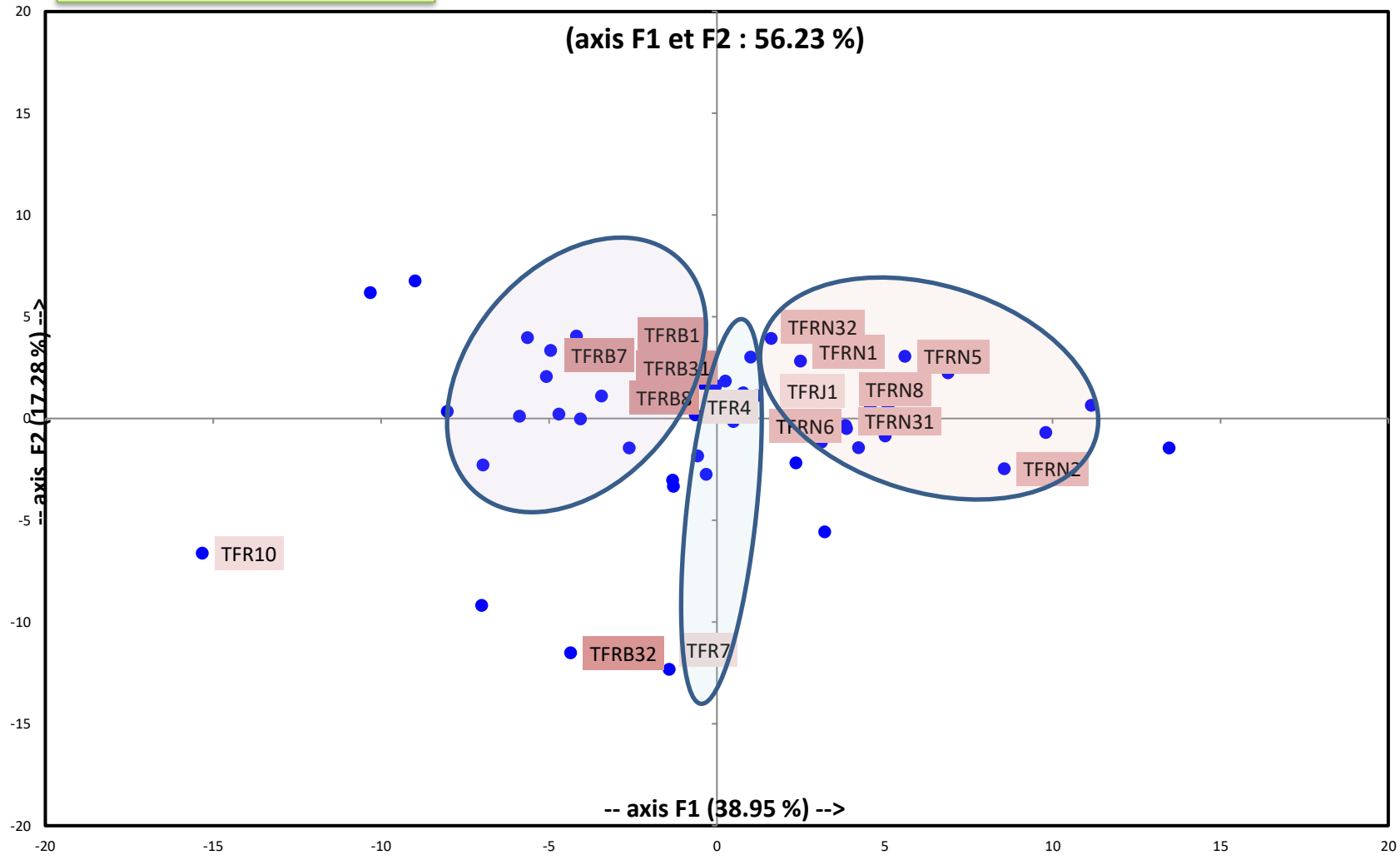
Base without taferyalet.



Results and discussion

Principal component analysis

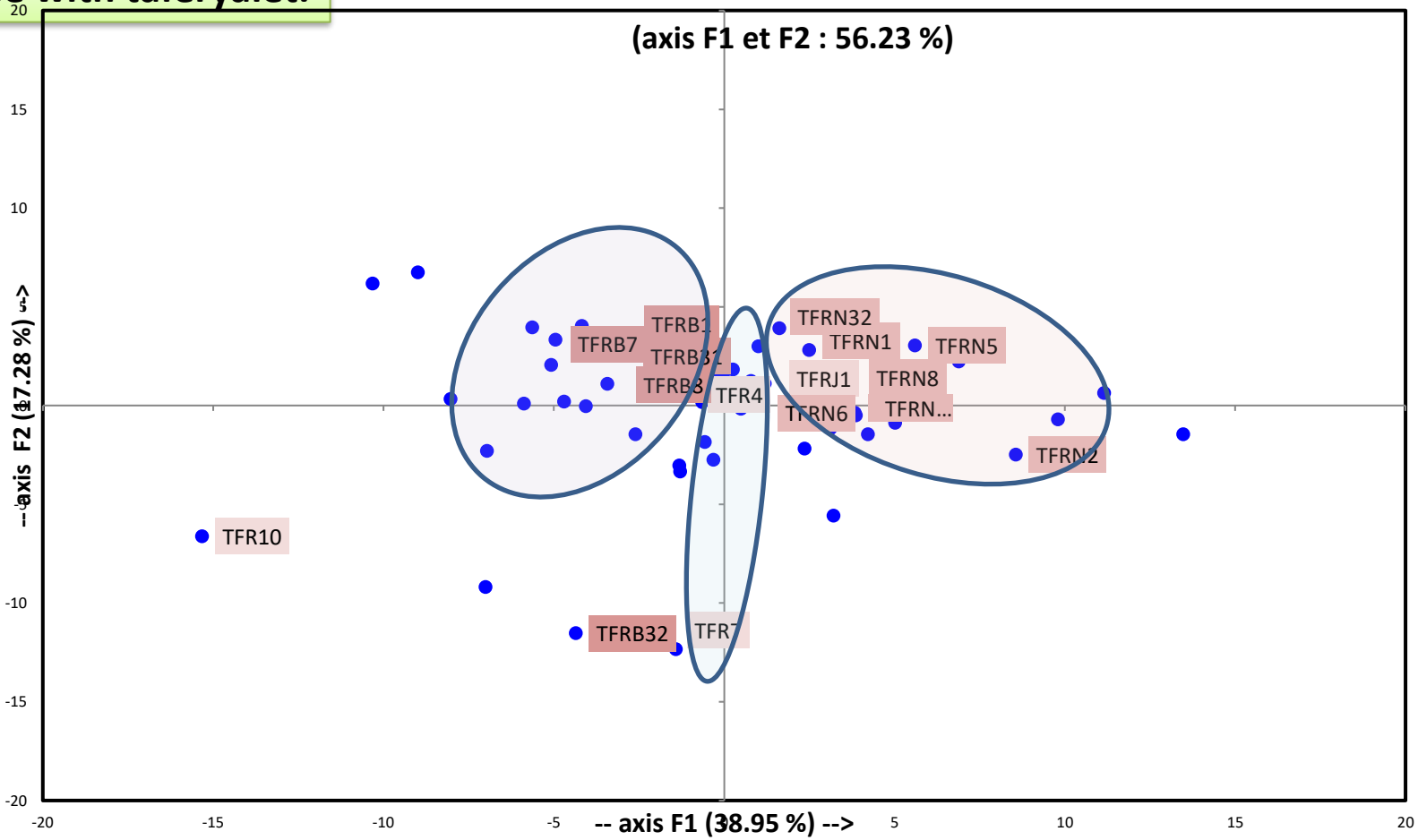
Base with taferyalet.



Results and discussion

Principal component analysis

Base with taferyalet.



Category 1: TFRN and TFRJ; Category 2: TFR; Category 3: TFRB.

conclusion and perspectives

The study was based on the morphological characteristics of the leaf, it has been shown that there is a important variability of intra and intervarietal.

Highlighted diversity in a small and relatively limited territory

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