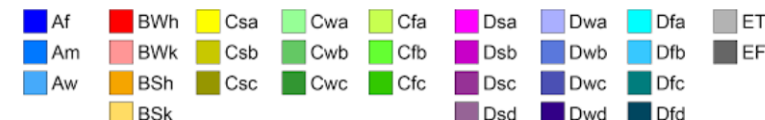
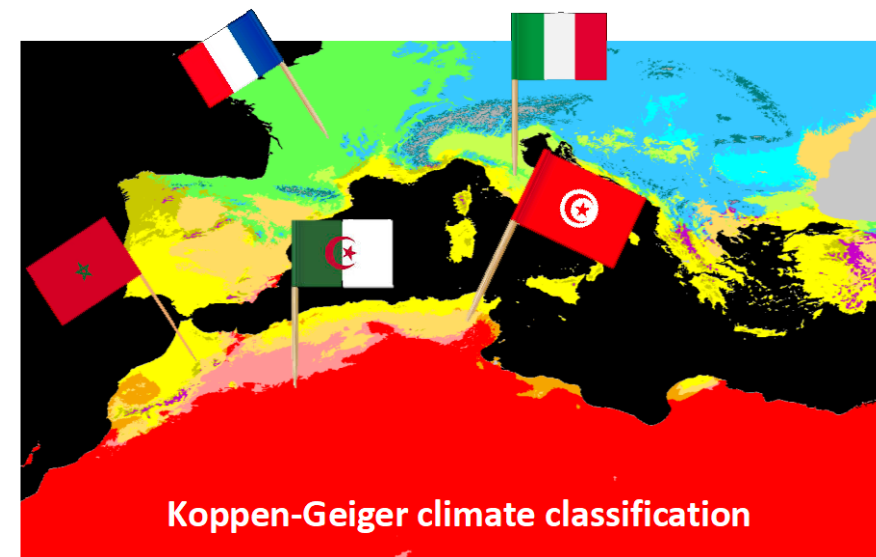


Drafting the genomic landscape of North African sheep and chicken adaptation to harsh environments

P. Ajmone Marsan, B. Benjelloun, M. Ben Larbi, A. Carta, G. Chillemi, S. B. S. Gaouar, H. El-Hentati, A. Jannoune, C. Jerrari, H. Khemiri, V. Loywick, N. M'Hamdi, N. Tabet Aoul, A. Stella, M. Tixier-Boichard, R. Valentini, G. Zitouni

SCALA-MEDI

Improving sustainability and quality of Sheep and Chicken production by leveraging the Adaptation potential of Local breeds in the MEDITerranean area.



UNIVERSITIES



RESEARCH INSTITUTES



BREEDER ASSOCIATIONS



SME



GENE BANK



Socio economy



Diversity



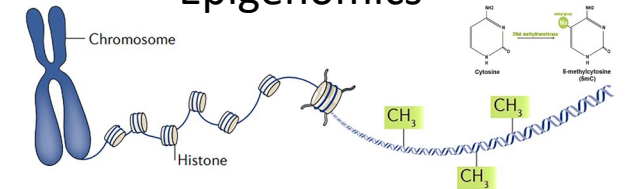
Phenotypes

Genomics

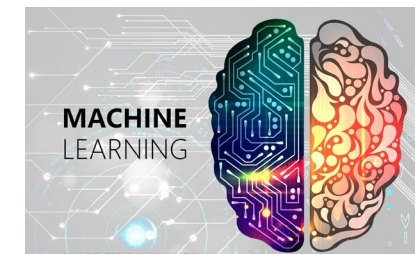


Adaptation

Epigenomics



Artificial intelligence



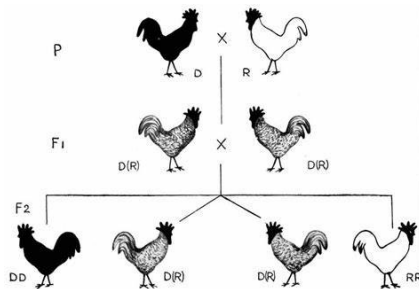
Use and
conservation

***Local sheep and
chicken in Morocco,
Tunisia and Algeria***

Breeding

Modelling

Breeding centers

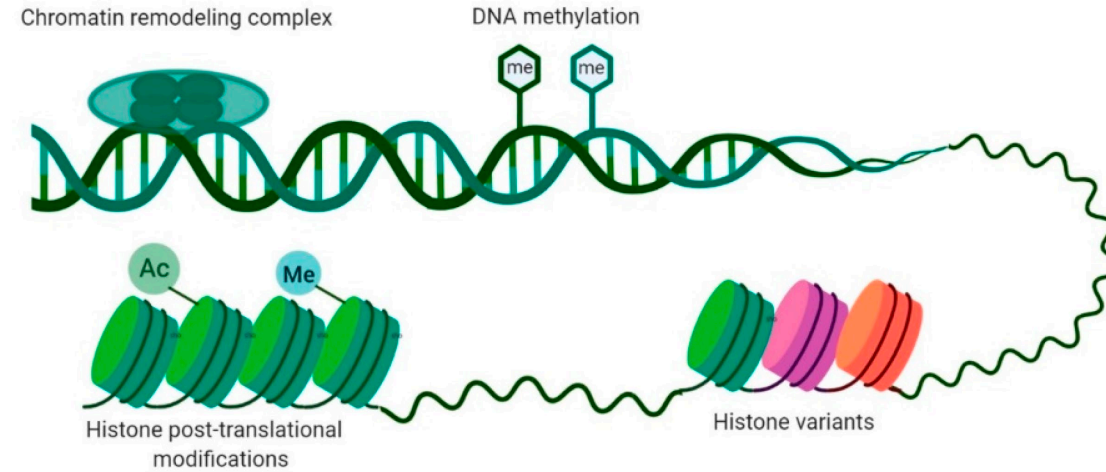


Stakeholder opinion

Regions	Chicken	Consumers	PolicyMakers	SalesPoint	Sheep	Veterinarians	Total
<i>Algeria</i>	102	112	8	31	54	51	358
<i>Morocco</i>	114	154	7	389	138	14	816
<i>Tunisia</i>	116	172	3	104	68	13	476
<i>Total</i>	332	438	18	524	260	78	1650



Epigenetics



LUMA
LUminomethic Methylation Assay

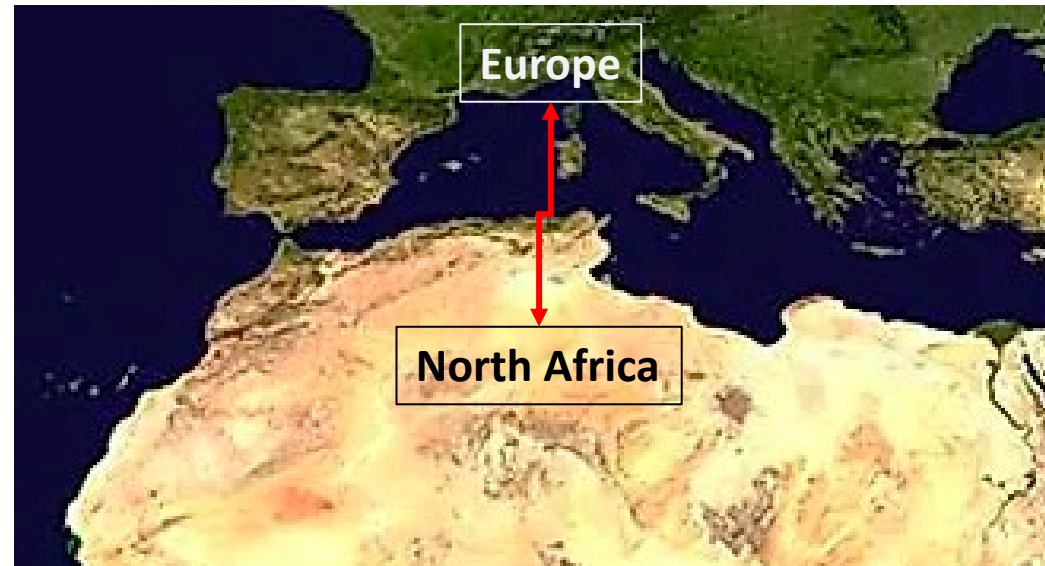


Global methylation

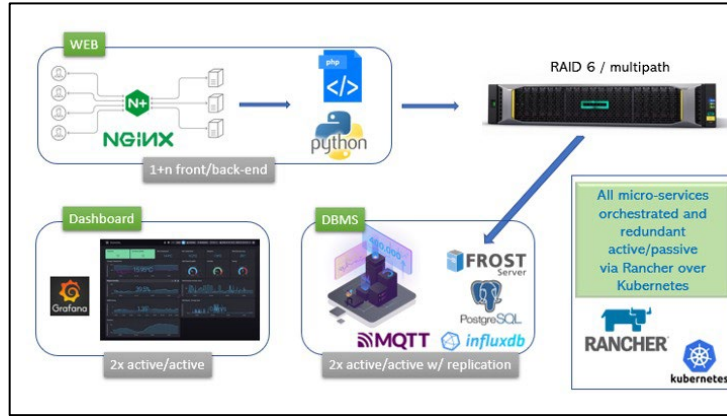
RRBS
Reduced Representation
Bisulphite Sequencing



Site-specific methylation

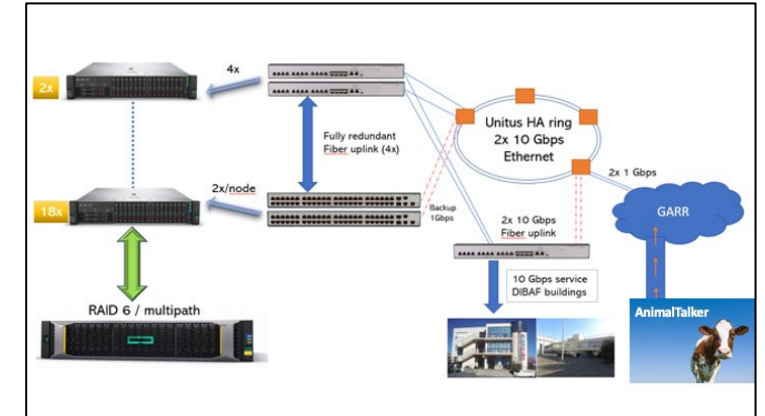


Software

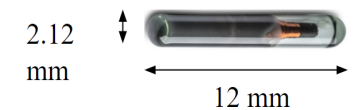
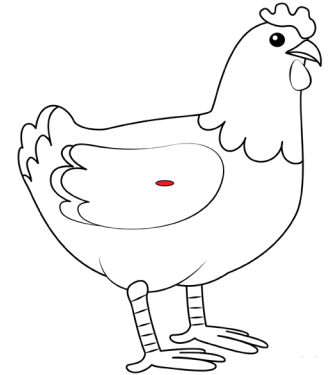
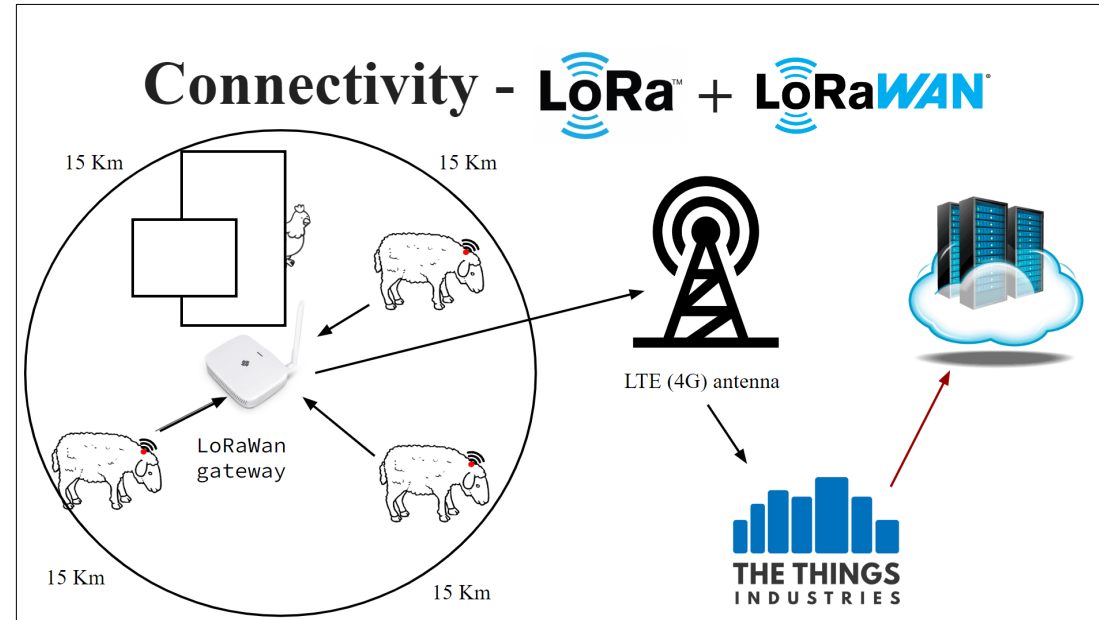


Remote phenotyping

Hardware



- Animal Tag
- Skin temperature
- Air temperature
- Air humidity
- Animal Movements (X, Y, Z)
- Heart-beat rate
- Oxygen saturation



- Animal Tag
- Skin temperature

Breeding programs for sustainable production

Definition and revision of selection objectives and selection indexes
Breeding goals → **Traits of interest + genetic diversity**

Morocco

Genomic selection of the Sardi sheep breed



Morocco

Development of a certified Beldi chicken breeding program



Algeria

Crossbreeding between two local chicken founder lines

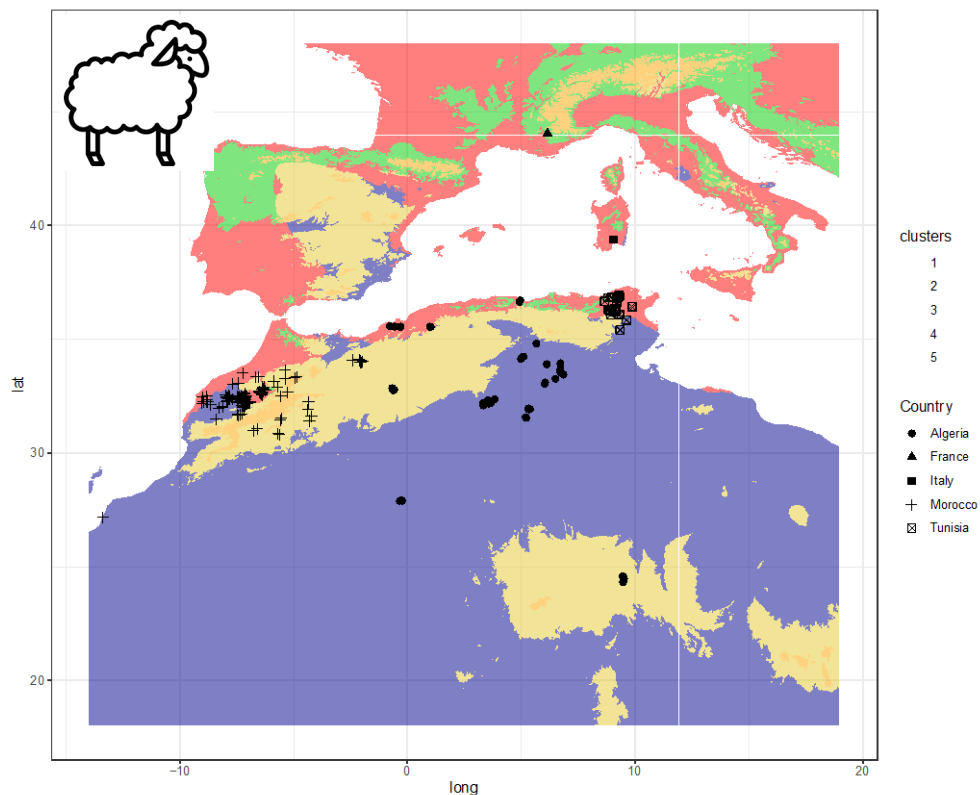


Tunisia

Pure breeding of local chicken

Local chicken crossbreeding with Sasso breed

Sampled 3011 sheep from 17 breeds and 277 farms



- Total n. animals genotyped: 2070 (1200 Moroccan Beldi)
- Working dataset:
 - 861 animals
 - 20 breeds
 - 4515 SNPs

Breed Code	Country	Breed	N° samples	Array
ALG-DMN	Algeria	Dman	32	Image001V2 (11K)
ALG-HMR	Algeria	Hamra	31	Image001V2
ALG-ODJ	Algeria	Ould Djellal	44	Image001V2
ALG-RMB	Algeria	Rembi	36	Image001V2
ALG-SDN	Algeria	Sidaoun	24	Image001V2
ALG-TAZ	Algeria	Tazegzaweth	46	Image001V2
MOR-BGL	Morocco	Beni Guil	50	Axiom (50K)
MOR-BJD	Morocco	Boujaad	50	Axiom
MOR-DMN	Morocco	Dman	47	Axiom
MOR-SRD	Morocco	Sardi	50	Axiom
MOR-TIM	Morocco	Timahdite	50	Axiom
TUN-BBR	Tunisia	Barbarine	95	Image001V2
TUN-NDT	Tunisia	Noire de Thibar	71	Image001V2
TUN-QFO	Tunisia	Queue fine de l'ouest	75	Image001V2
TUN-SSA	Tunisia	Sicilo-Sarde	60	Image001V2
FRA-PAS	France	Préalpes Du Sud	44	Image001V2
IT-SAR	Italy	Sarda	15	HD (660K)
ES-MRS	Spain	Spanish Merino	17	HD
PT-MPR	Portugal	Merino Preto	10	HD
GB-SBF	United Kingdom	Scottish blackface	14	HD



IT-Sarda



TUN- Sicilo-Sarde



TUN-Noir de Thibar



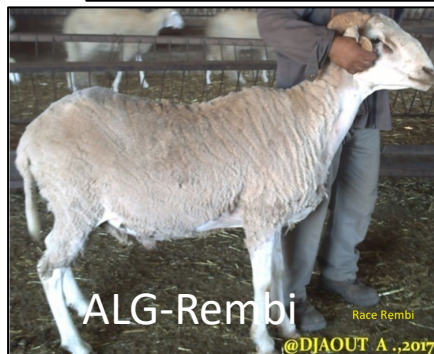
TUN-Barbarine-



TUN-Queue fine de l'Ouest



ALG-Tazegzwat-



ALG-Rembi



ALG-Ouled Djellal



ALG-Sidau



ALG-Hamra



ALG-D'Man



MOR-D'Man



MOR-Timadhite



MOR-Sardi



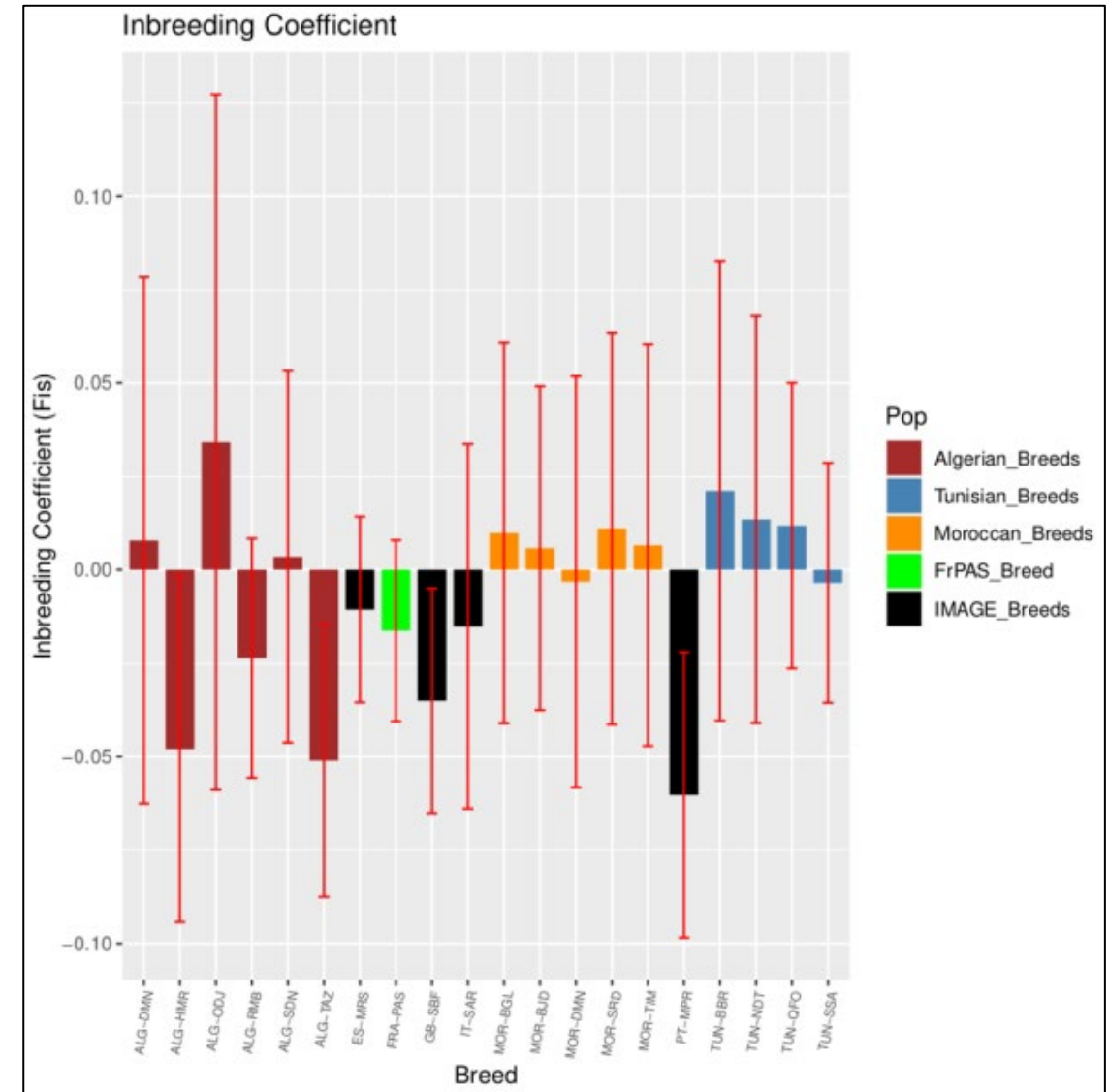
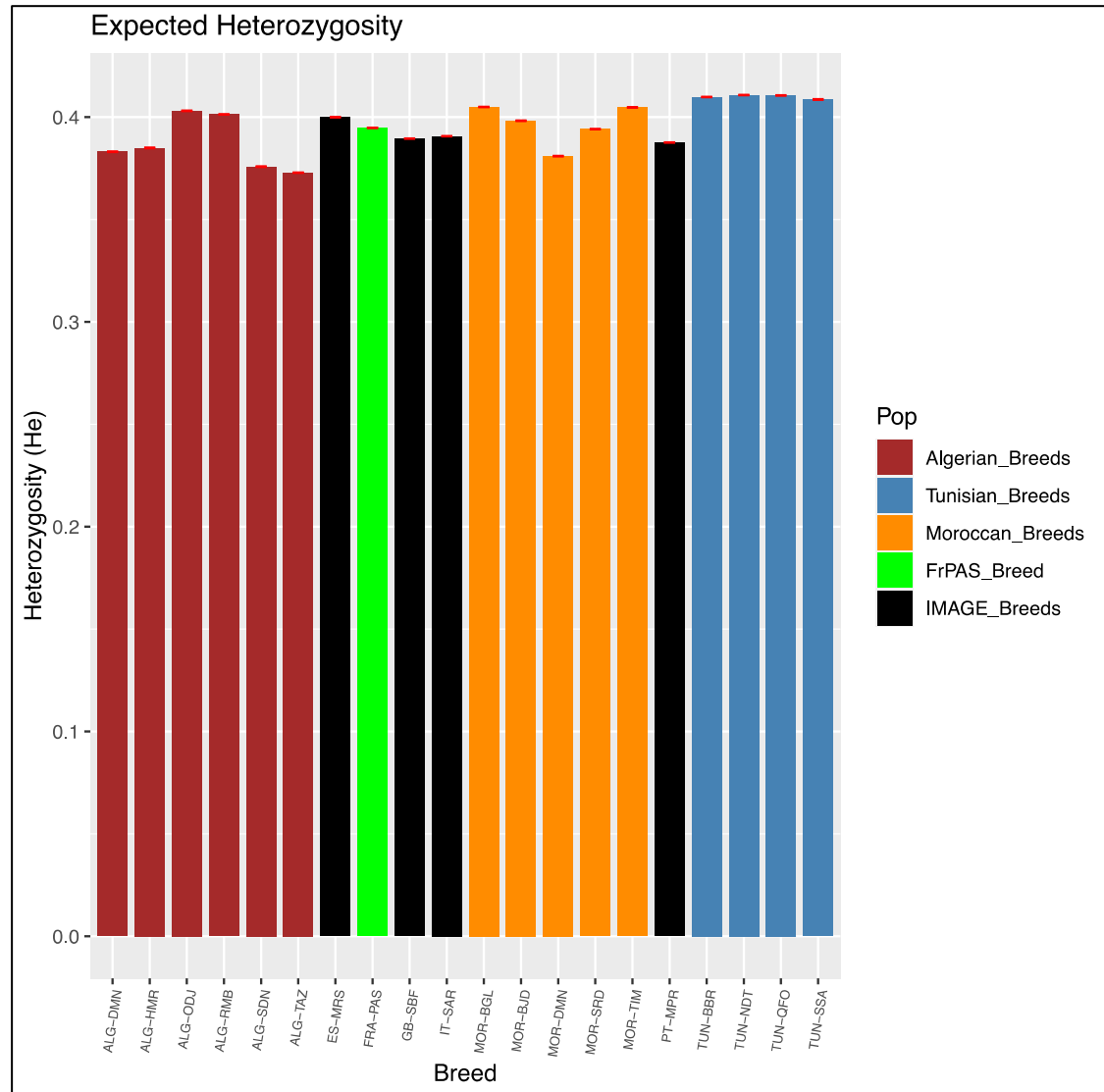
MOR-Beni Guil

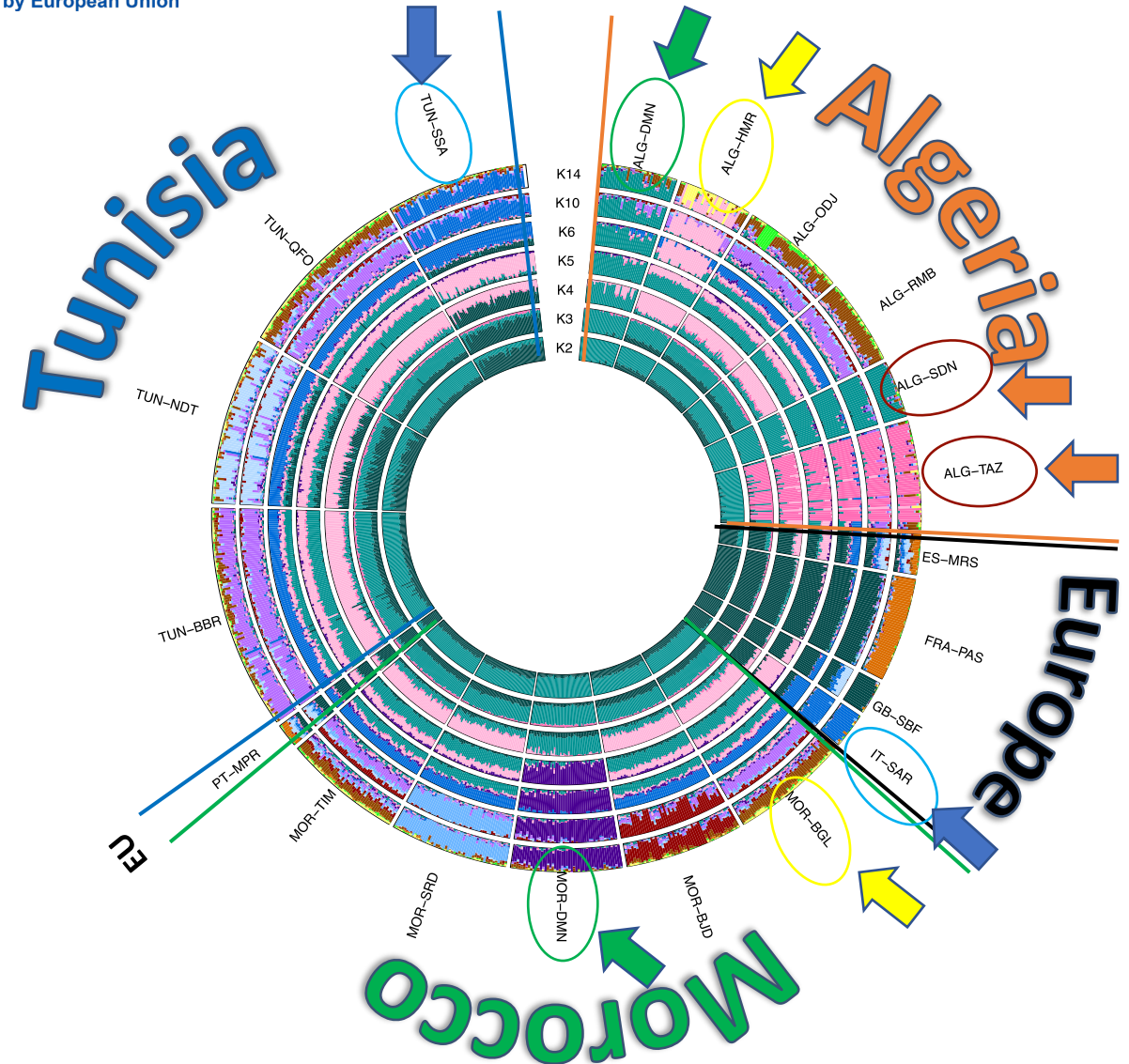
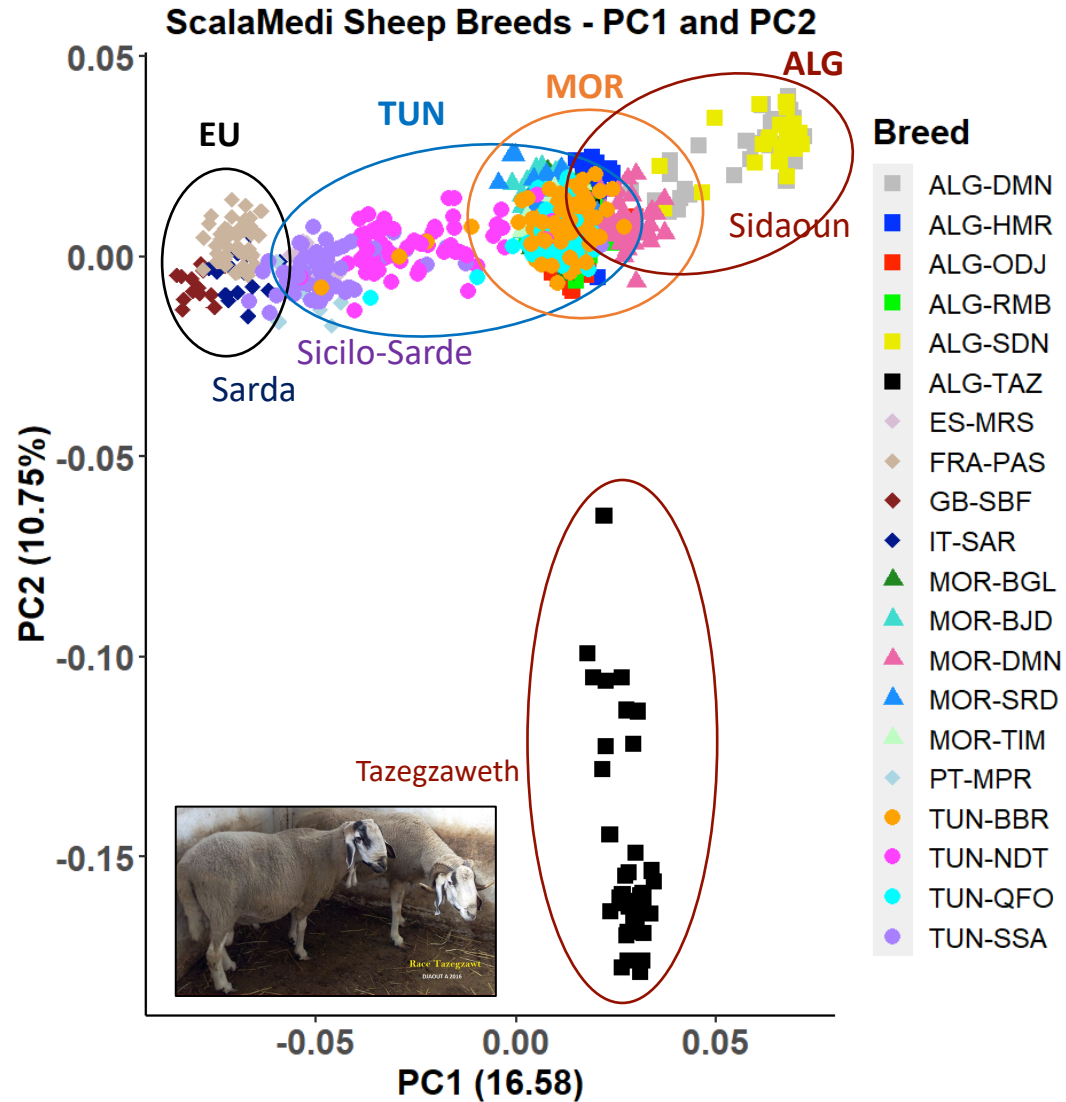


MOR-Boujaâd

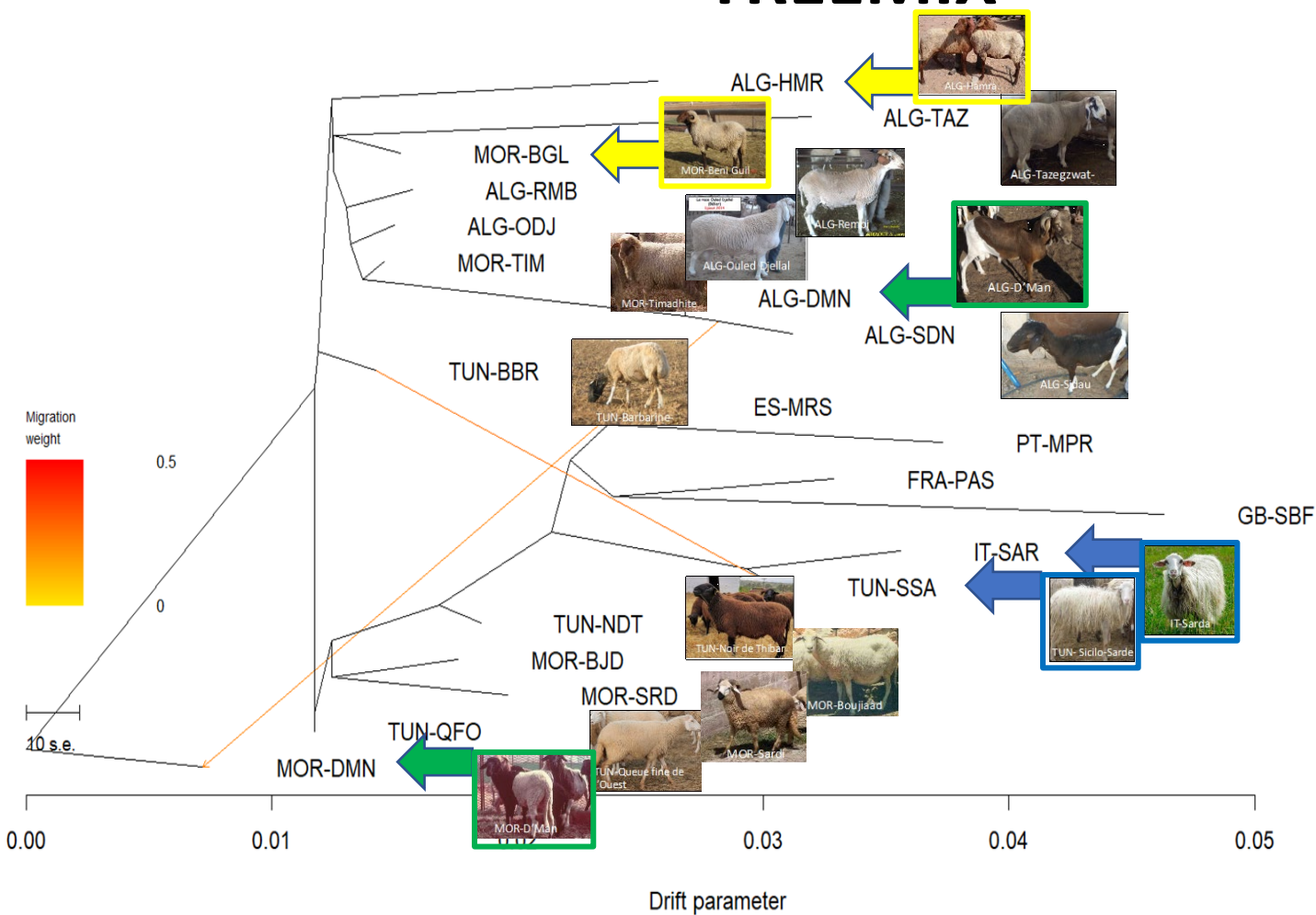


FR- Prealpes du Sud

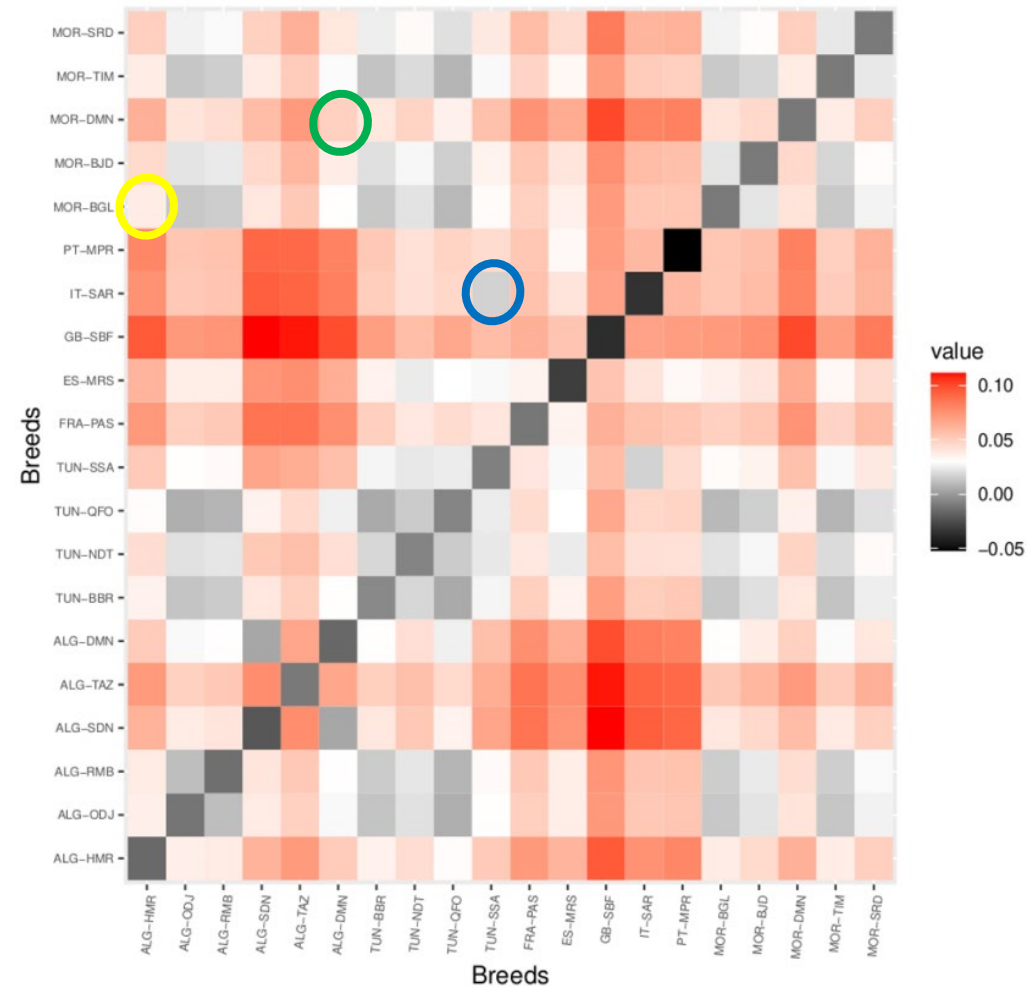




TREEMIX

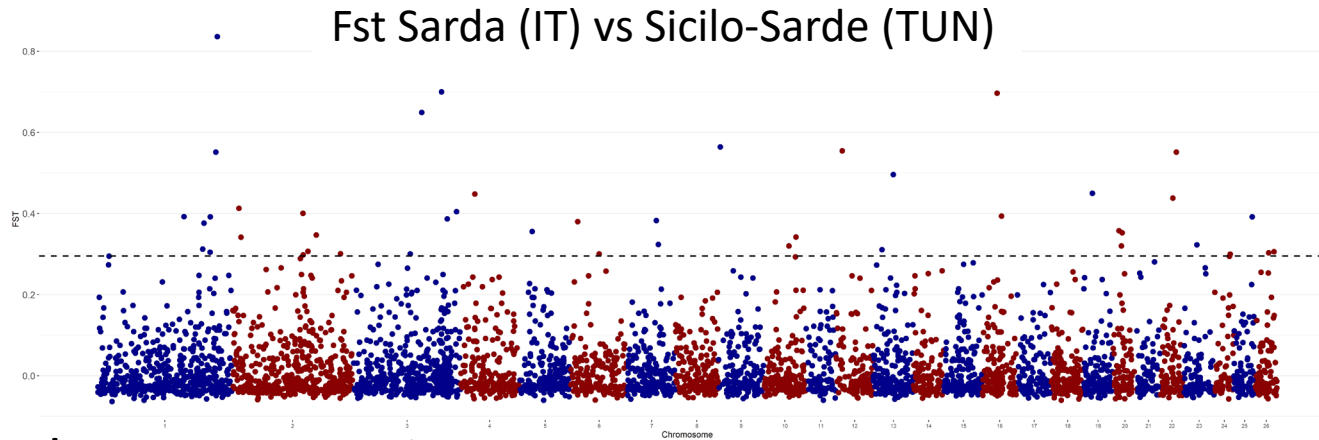


Pairwise FST HeatMap – Sheep



Genomics for adaptation to extreme environments

Selection signatures



Landscape genomics

- 19 climatic variables <https://www.worldclim.org/> + geography (altitude, longitude and latitude)

Low LD → very few markers

Planned HD genotyping and joining of data to those of the IMAGE project

Poster Session 72

Palazzo Congressi floor -1, from September 2nd at 17:00 until September 4th at 15:00

- 72.14 Screening continent-wide genomic diversity for local adaptation reveals strong signals of spatially divergent selection in European sheep
M. Barbato, E. Vajana, O. Selmoni, E. Somenzi, M. M. Passamonti, M. Tixier-Boichard, B. Lazzari, L. Colli, A. Stella, P. Ajmone Marsan



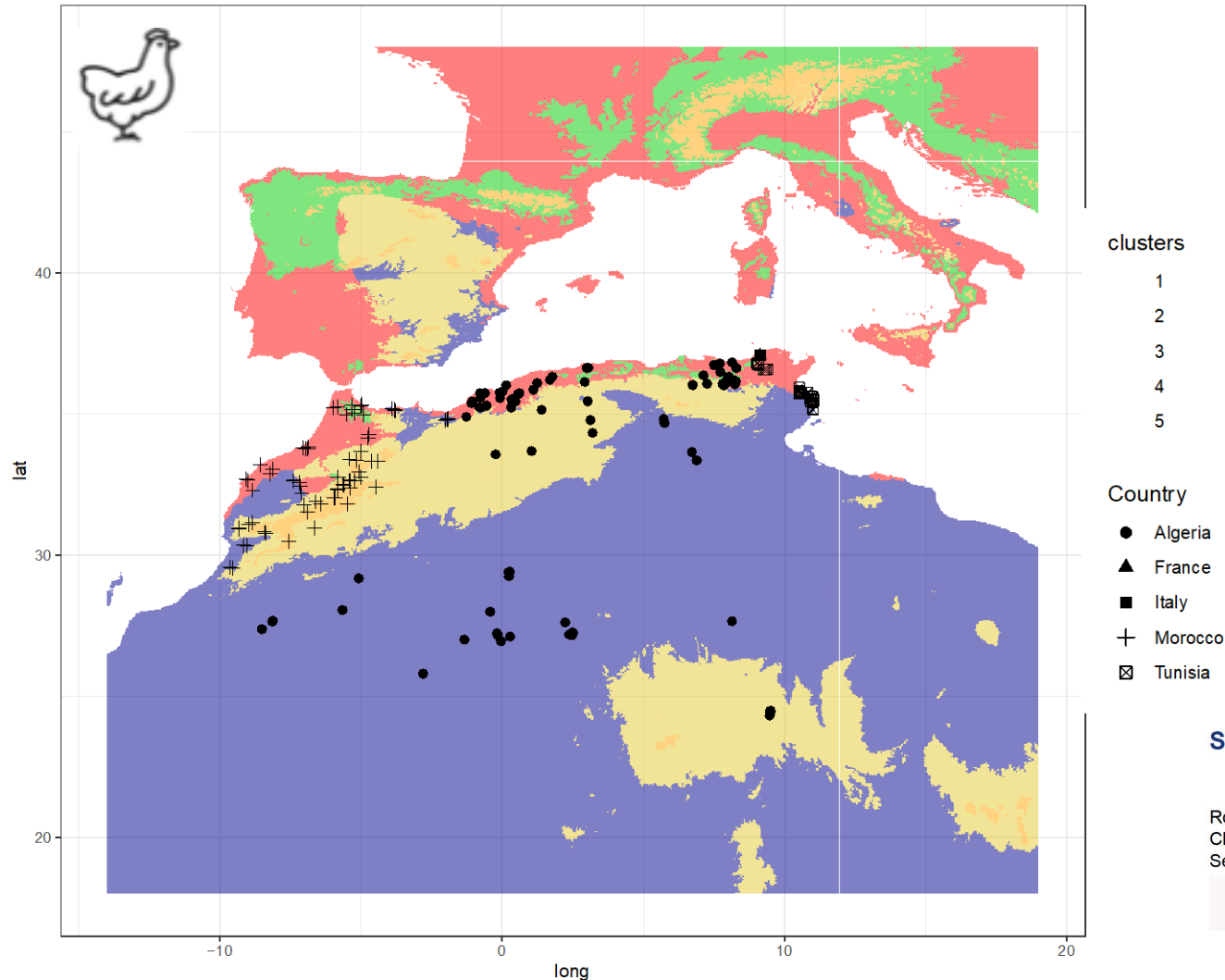
Mario Barbato, Messina University

CHR	CHR_NCBI	SNP	BP	FST	extra_info
1	NC_056054.1	OAR1_191206898.1	177394106	0,39224	Name=PLCXD2; description=phosphatidylinositol
1	NC_056054.1	OAR1_232926063.1	215850280	0,311966	Name=FNDC3B; description=fibronectin
1	NC_056054.1	OAR1_235707487.1	218483789	0,376244	Name=MECOM; description=MDS1
1	NC_056054.1	OAR1_235707487.1	218483789	0,376244	Name=LOC105605201; description=coiled-coil
1	NC_056054.1	OAR1_249059013.1	231059826	0,304235	Name=VEPH1; description=ventricular
1	NC_056054.1	OAR1_249213110.1	231232857	0,39157	Name=LOC132657285; description=uncharacterized
1	NC_056054.1	s54245.1	242574074	0,551389	Name=LOC101102861; description=phospholipid
1	NC_056054.1	OAR1_265350597.1	245712422	0,83629	Name=SLC9A9; description=solute
2	NC_056055.1	OAR2_155989203.1	147007898	0,298011	Name=KCNH7; description=potassium
2	NC_056055.1	OAR2_184407225.1	173981940	0,346754	Name=THSD7B; description=thrombospondin
2	NC_056055.1	OAR2_236352759.1	223564458	0,300507	Name=EPHA4; description=EPH
3	NC_056056.1	OAR3_126893362.1	118982570	0,300362	Name=TMTC2; description=transmembrane
3	NC_056056.1	OAR3_196913312.1	182916410	0,699668	Name=FSO4; description=FYVE
3	NC_056056.1	OAR3_209554027.1	194807002	0,386419	Name=PDE3A; description=phosphodiesterase
3	NC_056056.1	s08452.1	213653377	0,404588	Name=ERC1; description=ELKS/RAB6-interacting/CAST
4	NC_056057.1	OAR4_31025338.1	29512838	0,447753	Name=TMEM196; description=transmembrane
5	NC_056058.1	OAR5_31327589.1	28277675	0,355751	Name=TRNAR-CCU; description=transfer
5	NC_056058.1	OAR5_31327589.1	28277675	0,355751	Name=PRDM6; description=PR/SET
6	NC_056059.1	OAR6_65100822.1	59116808	0,300004	Name=WDR19; description=WD
7	NC_056060.1	OAR7_65772265.1	59878573	0,382601	Name=FBN1; description=fibrillin
7	NC_056060.1	s33691.1	64034963	0,323696	Name=LOC132660054; description=uncharacterized
9	NC_056062.1	s69406.1	4677485	0,56401	Name=LMBRD1; description=LMBR1
10	NC_056063.1	OAR10_53442918.1	52388827	0,319733	Name=LOC132657257; description=uncharacterized
10	NC_056063.1	OAR10_69000458.1	66747944	0,341797	Name=GPC5; description=glypican
13	NC_056066.1	s32845.1	18330642	0,31071	Name=PAR3; description=par-3
13	NC_056066.1	OAR13_45492904.1	41443275	0,495798	Name=THBD; description=thrombomodulin
13	NC_056066.1	OAR13_45492904.1	41443275	0,495798	Name=LOC132657554; description=uncharacterized
13	NC_056066.1	OAR13_45492904.1	41443275	0,495798	Name=CD93; description=CD93
15	NC_056068.1	OAR15_61395591.1	56025501	0,788089	Name=ANO3; description=anocytin
15	NC_056068.1	OAR15_61395591.1	56025501	0,788089	Name=MUC15; description=mucin
20	NC_056073.1	s71288.1	13425015	0,357161	Name=KIF6; description=kinesin
20	NC_056073.1	s75942.1	18216702	0,319733	Name=SUPT3H; description=SPT3
20	NC_056073.1	s14399.1	20027429	0,352323	Name=ADGRF5; description=adhesion
22	NC_056075.1	OAR22_38465369_X.1	33627363	0,551389	Name=NRAP; description=nebulin
24	NC_056077.1	OAR24_36511570.1	33438700	0,299567	Name=GTF2IRD1; description=GTF2I
26	NC_056079.1	OAR26_43055353.1	37994382	0,305612	Name=PSD3; description=pleckstrin

SLC9A9 Na⁺/H⁺ exchanger → cell osmotic regulation tolerance to dehydration?
7 genes involved in cardiovascular system



Sampled 1089 village chickens from 297 farms in 56 provinces/governorates



10K SNP IMAGE1v2 Array: 4585 SNPs after QC.

Country/ origin	Working dataset
Algeria	285
Morocco	368
Tunisia	115
Total	768

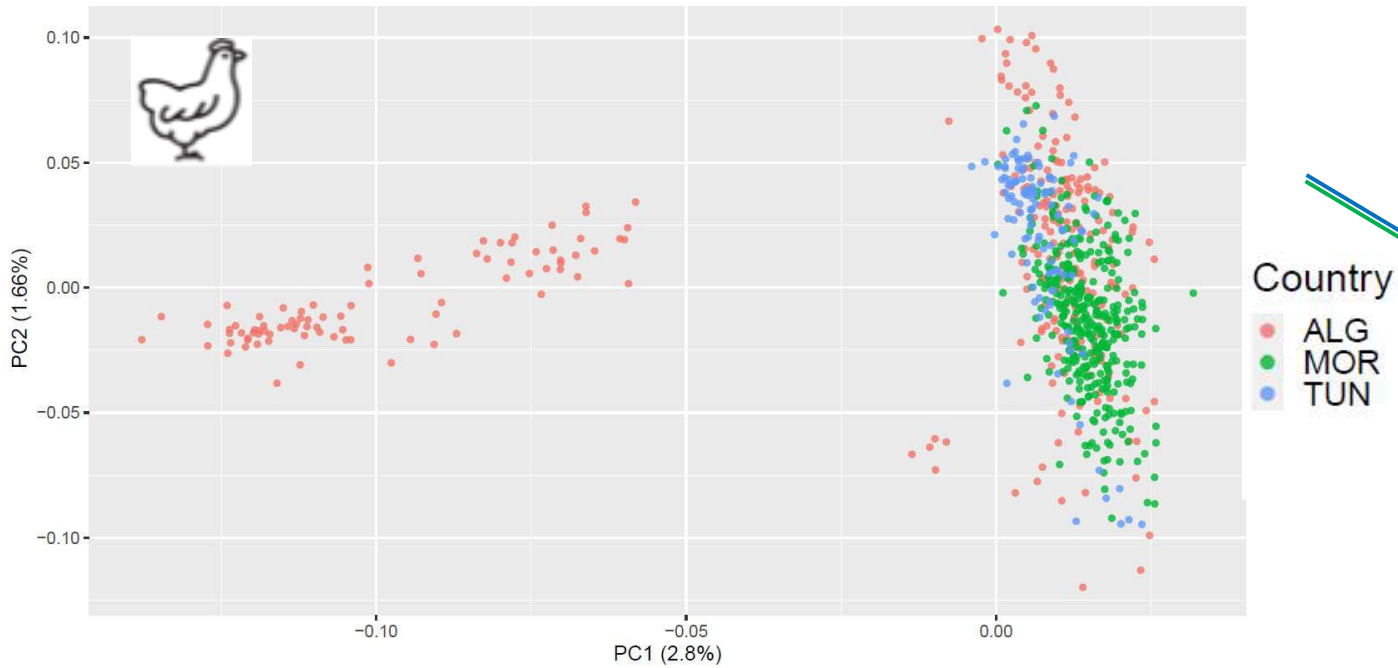
Session 16. Genomic selection tools for within- and across- herd management in livestock species

Room: Pisana - Palazzo Congressi 2nd Floor
Chair: Kargo / Lourenco
Session Type: Theme session

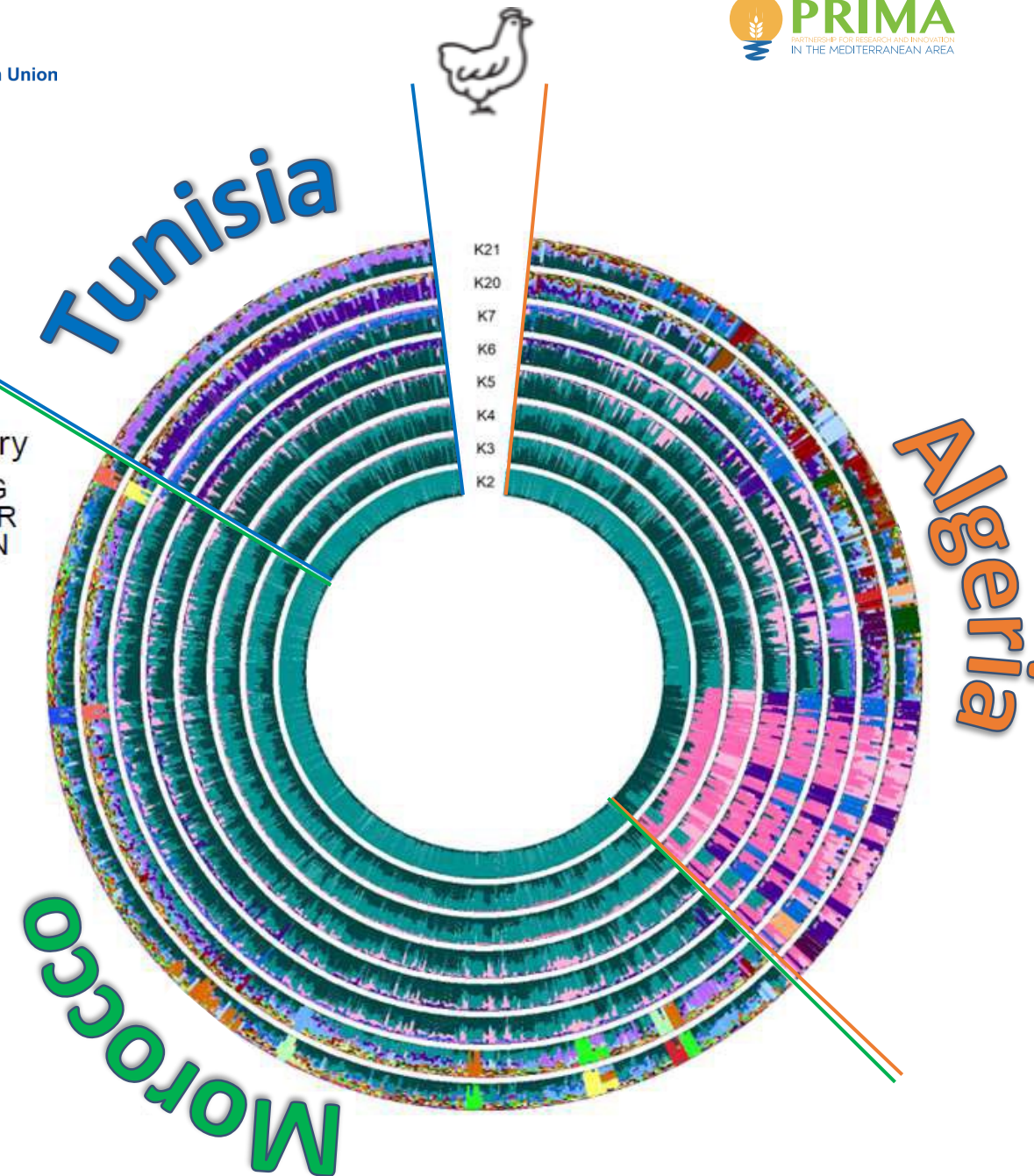
Theatre Session 16

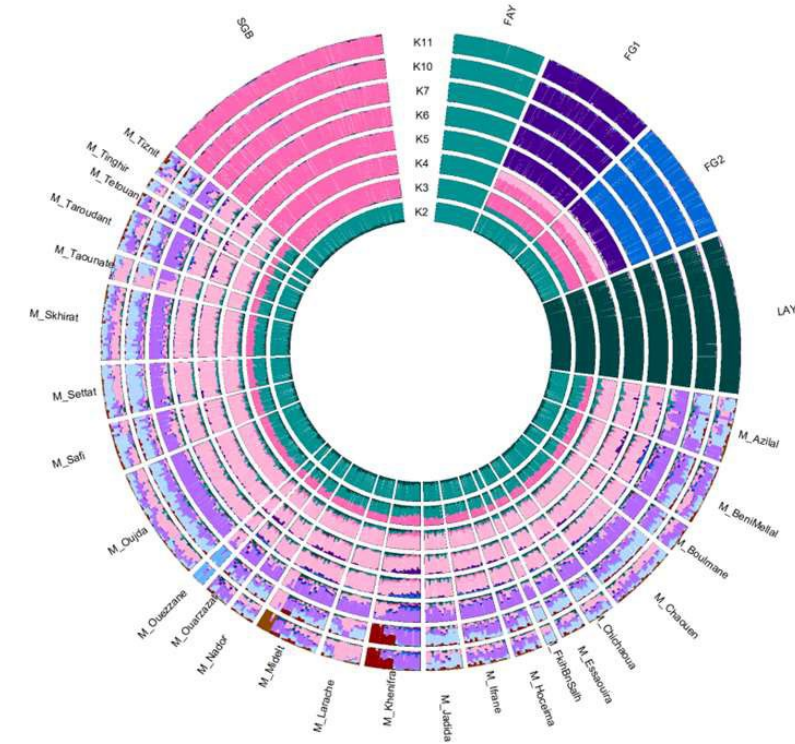
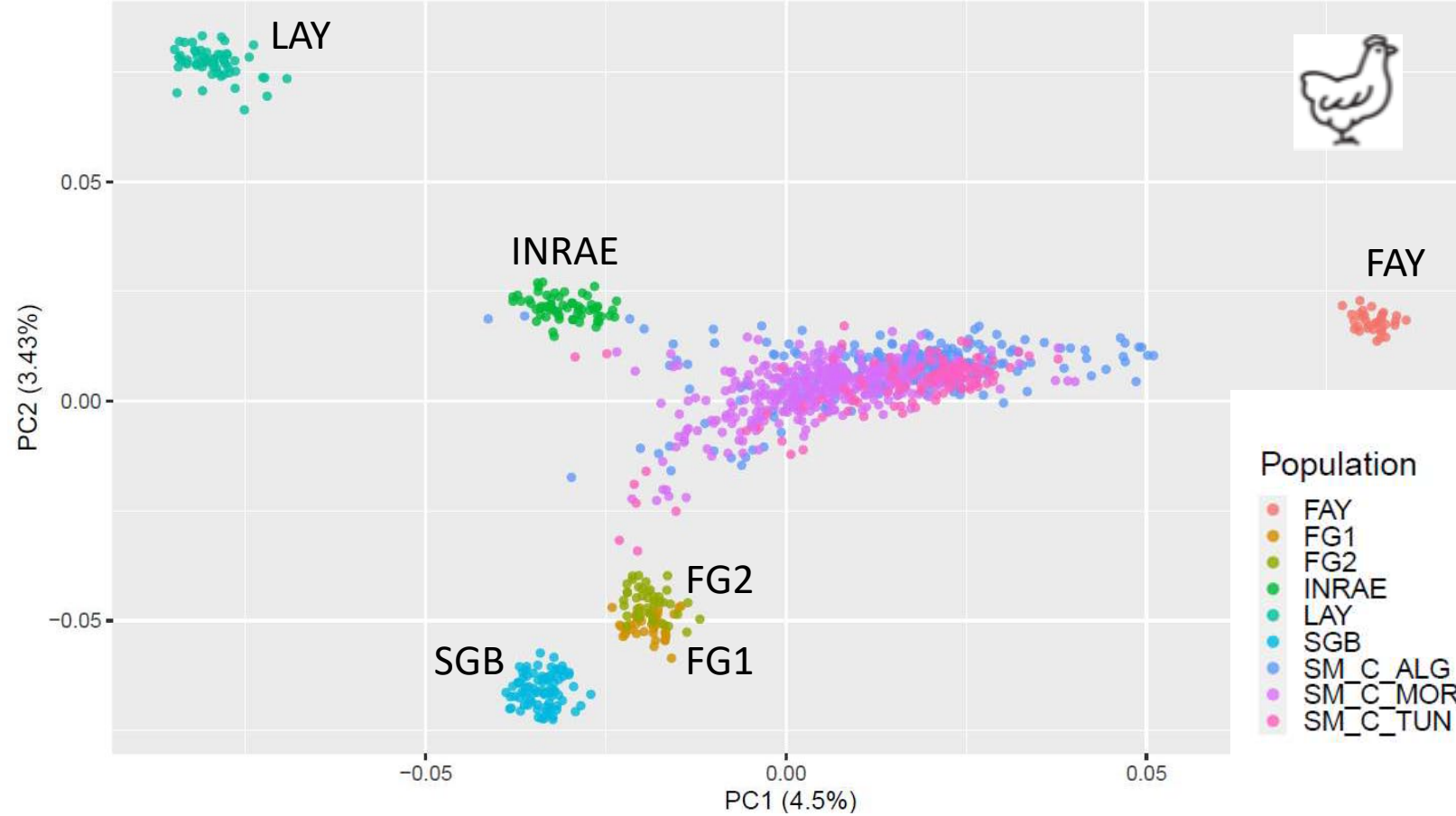
Book of Abstracts page

14:00 Genetic diversity of local chickens in the Mediterranean area: Morocco, Algeria and Tunisia 295
S. Ait Tizi, S. Simma, A. Ouhrouch, M. Milanese, B. Badaoui, M. Benbati, B. El Amiri, M. Ibnelbachyr, E. M. Sekkour, O. Mahir, N. Tabet-Aoul, F. Z. Mahammi, S. B. S. Gaouar, M. Ben Larbi, E. Somenzi, M. Tixier-Boichard, P. Ajmone Marsan, B. Benjelloun



Low distinctiveness between and along countries
Exception: populations in two Algerian breeding centers





Commercial breeds

FAY: Fayoumi (Egyptian)

FG1: (Fast growing commercial broiler 1)

FG2: (Fast growing commercial broiler 2)

INRAE: Dual purpose breed

LAY: (Laying hens)

SGB: (Slow Growing Broiler)



