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Livestock Biodiversity Workshop Rome 5-6th May 2010

Current status of the evaluation of genetic diversity in livestock breeds

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Comprehensive review on current state of knowledge
for

cattle, yak, water buffalo,
sheep, goats, camelids,
pigs, horses and chickens.

in

Groeneveld LF, Lenstra JA, Eding H, Toro MA, Scherf B, Pilling D, Negrini R,
Finlay EK, Jianlin H, Groeneveld E, Weigend S. Genetic diversity in farm
animals; a review. **Animal Genetics** 2010;41(s1):6-31.

Focus today:

Part 1: Chickens (S. Weigend)
Part 2: Cattle (J.A. Lenstra)

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Domestication of the chicken

Species of Jungle Fowl (*Gallus*)




G. Varius
(Green Jungle Fowl)



G.gallus
(Red Jungle Fowl)



G.Lafayetteii
(Sri Lanka Jungle Fowl)



G.sonneratii
(Grey Jungle Fowl)

5 Subspecies of Jungle Fowl (*Gallus gallus*)

G.g. gallus

Southeast Asia
(Thailand, Vietnam)

G.g. murghi

India

G.g. jabouillei

Southeast Asia
(Vietnam; Laos,
Southwest China)

G.g. spadiceus

Southeast Asia
(Burma, Malaysia
Southwest China)

G.g. bankiva


Southeast Asia
(Java, Bali;
Sumatra)


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Domestication of the chicken

Species of Jungle Fowl (*Gallus*)





G.sonneratii
(Grey Jungle Fowl)

Eriksson et al., PLoS Genet 2008

Beta-carotene dioxygenase 2 (BCDO2)
=> degradation of carotenoids
tissue-specific regulatory mutation(s)
=> inhibit expression of BCDO2
=> yellow skin

Mutation - *Gallus sonneratii*, not *Gallus gallus*

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Domestication of the chicken

**Multiple domestication events in chickens
(4.000 – 6.000 YBP)**

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Use of 30 microsatellites suggested by FAO for biodiversity studies in chickens (FAO, 2004)

Reference	Origin of breeds	# of breeds	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Granevitze 2007	Asian, European	65																															
Muchadeyi 2007	Zimbabwean	13																															
Bodzar 2009	Hungarian	9																															
Cuc 2010	Vietnamese	9																															
Berthouly 2008	French, Asian	20																															
Mwacharo 2007	East African	19																															
Tadano 2007	Japanese	11																															
Tadano 2008	Japanese	8																															
Zanetti 2007	Italian	5																															
Total # breeds genotyped per marker			153	153	153	153	153	148	148	148	148	148	148	148	143	138	138	138	136	136	136	131	131	131	133	133	116	116	116	19	19		
Total = 159 chicken populations / 6 in common																																	

29 Microsatellites distributed across 15 chromosomes

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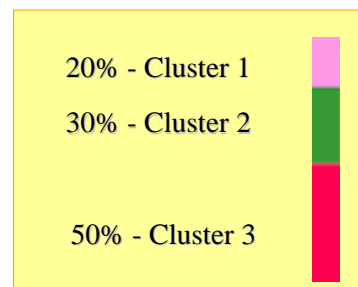
85 Chicken Populations of different geographic origin, breed history and management system

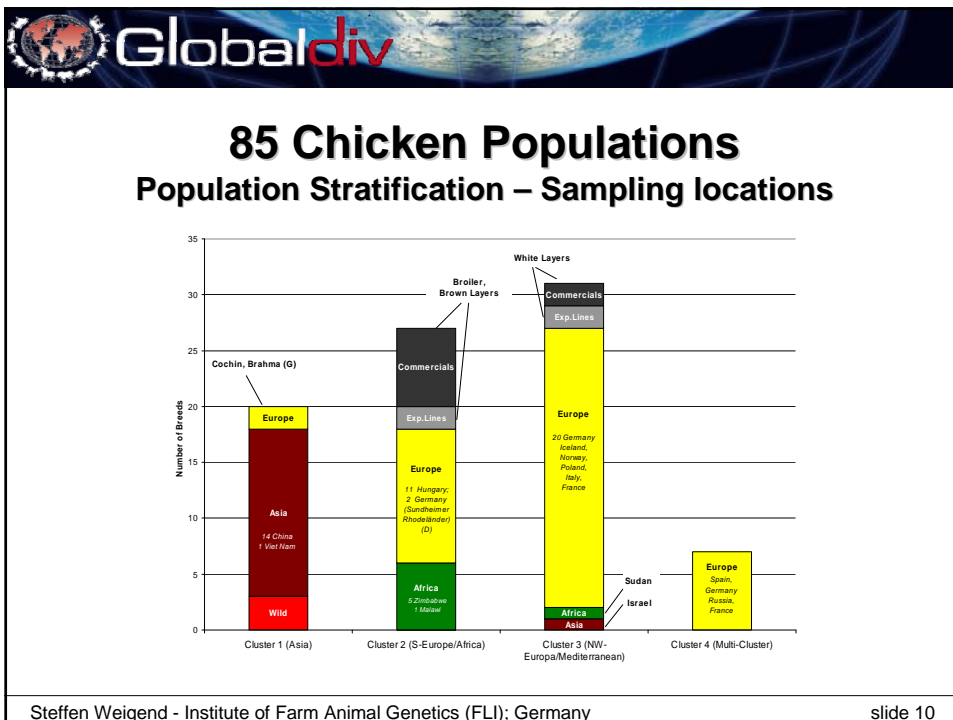
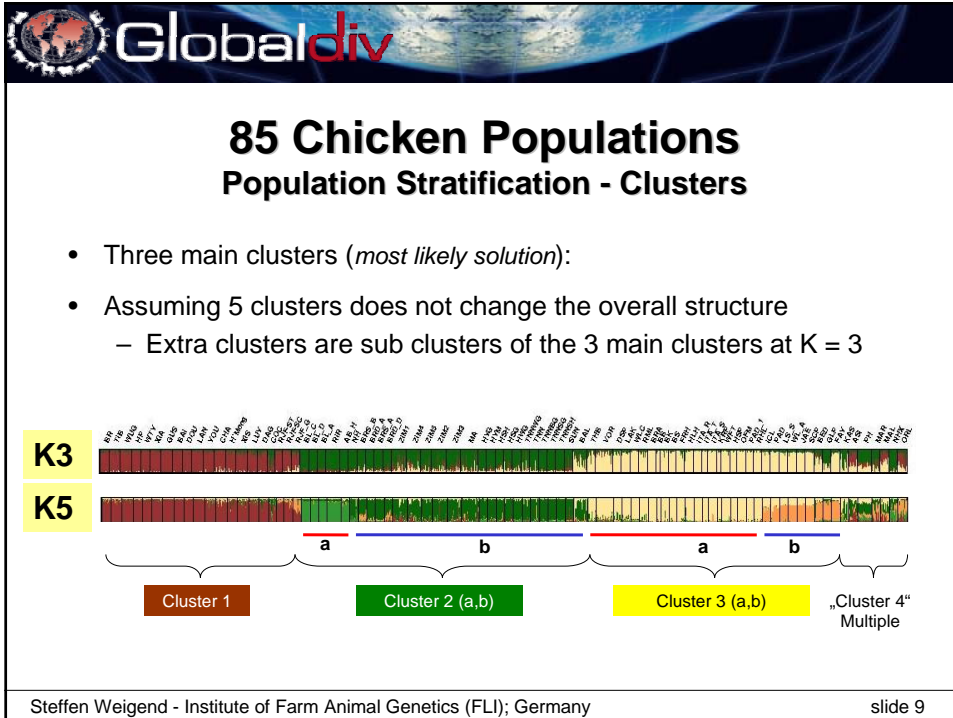
- Red Jungle Fowl (3)
- Pure bred lines
 - commercial (9)
 - experimental (4)
- Local Populations
 - European (46)
 - Asian (16)
 - African (7)

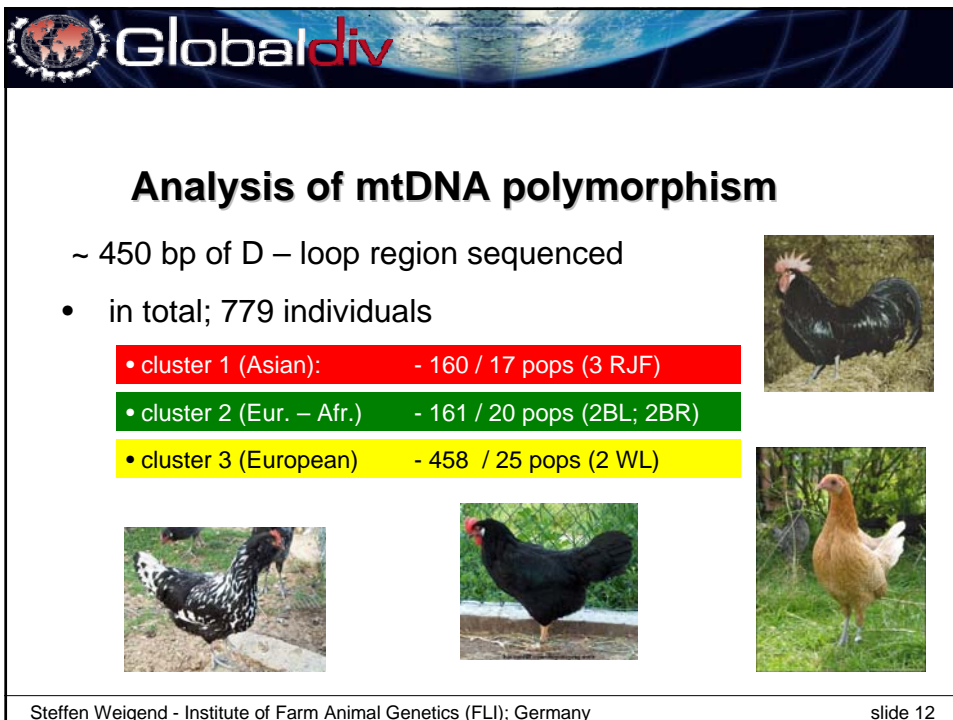
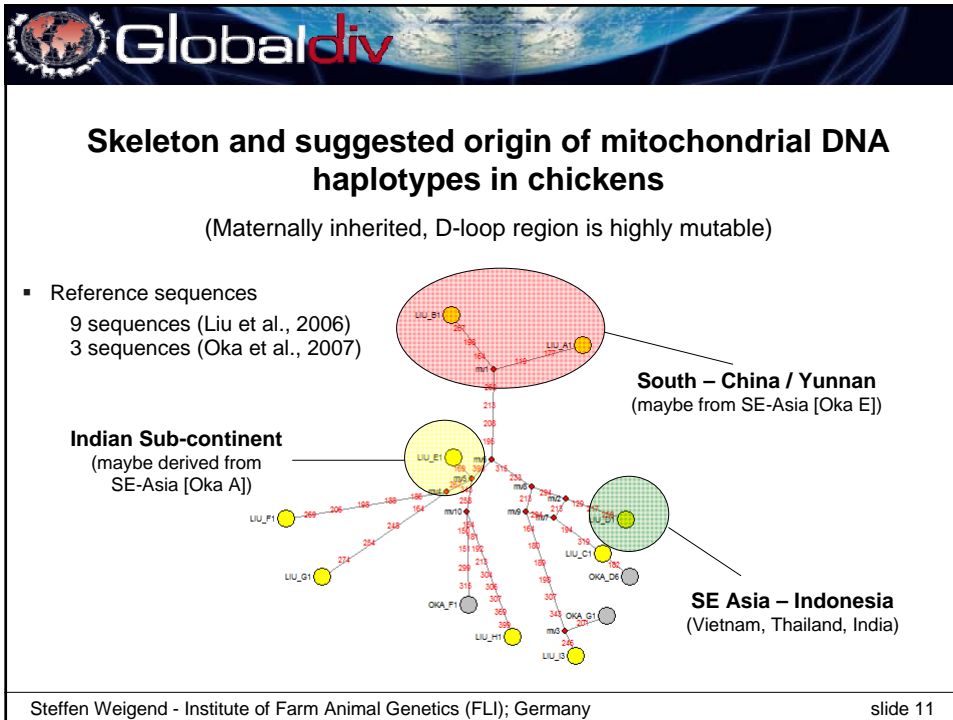


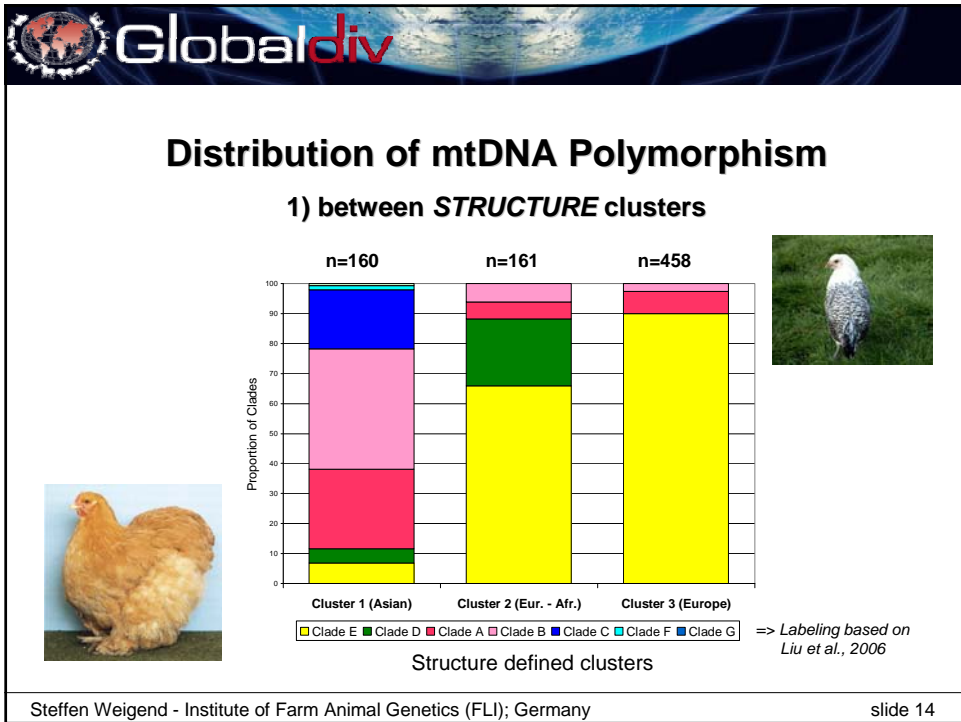
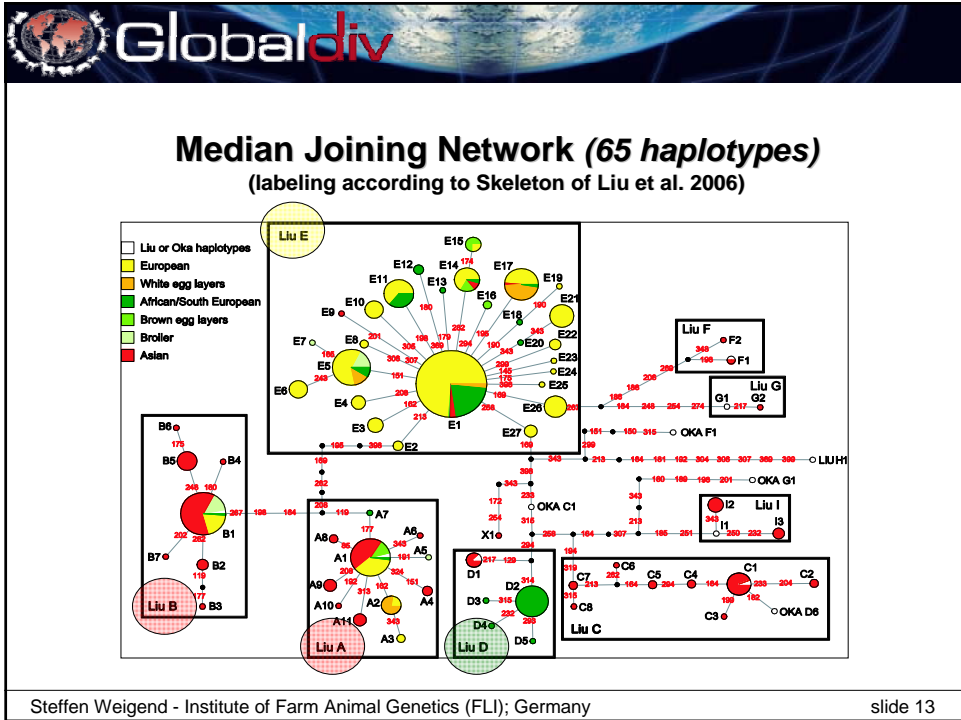
85 Chicken Populations Population Stratification based on Microsatellite Genotypes

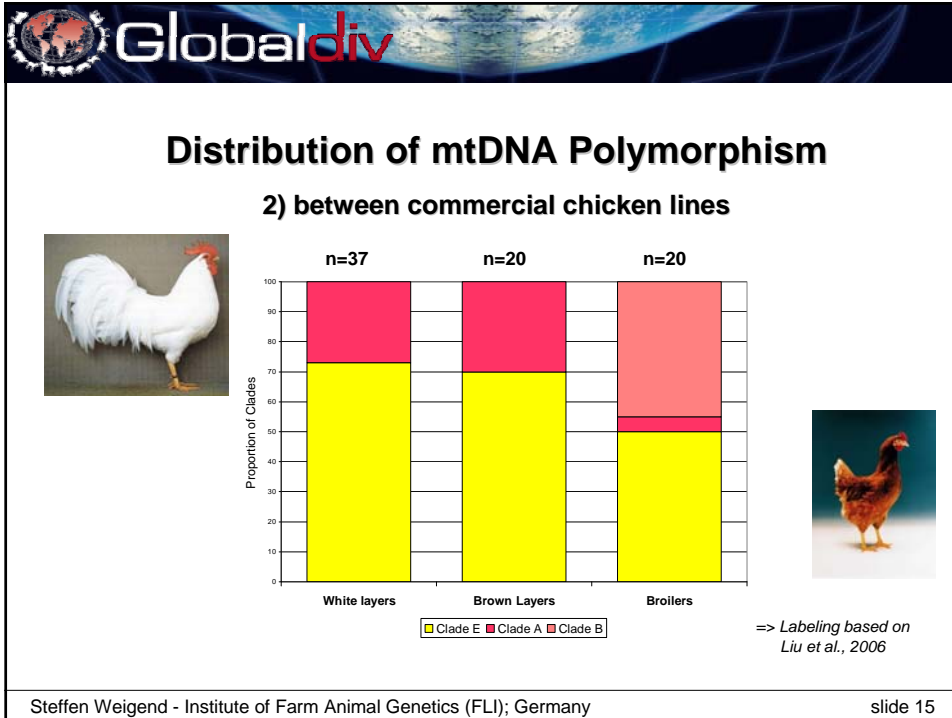
- Clustering algorithm - Individuals placed into a user defined number of K clusters (STRUCTURE software)
- Membership coefficient Q – portion of i^{th} genome in each cluster
- Best solution identified based on repeatability of individual runs
- Q values of best solution visualized using DISTRUCT software











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- ## Summary (part1 – chickens)
- **Multilocus Clustering based on microsatellites divides the gene pool of 85 populations into 3 main groups**
 - *W Europe/ Asia / SE Europe and Africa*
 - **Analysis of mtDNA polymorphism suggests**
 - *European breeds are mainly of Clade E (Indian sub-continent)*
 - *commercial lines are of admixed origin (Clades E and A&B)*
 - **Case study** (in terms of populations & markers)
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