The Origin and Diversity of Livestock Species in the Arabian Peninsula; a Genetic Review and Historical Background

Badar Ali Al-Qamashou (Ph.D)

General Diocecrate of Animal Wealth
Ministry of Agriculture and Fisheries
Muscat-Oman
Livestock species have played an important role in the agriculture and socioeconomic of human.

Livestock breeds in the Arabian Peninsula are characterized by high genetic diversity (*citation?!!??!*).
General impression
global animal biodiversity
Livestock species have played an important role in the agriculture and socioeconomic of human

Livestock breeds in the Arabian Peninsula
Genesis of the Arabian animal species: Interaction of geography, history and climate
Genesis of the Arabian animal species: Interaction of geography, history and climate

- Crossroads between Africa and Eurasia.
- Links the Arabian Sea, Indian Ocean and Red Sea.
Out of Africa

MAP KEY
- Present-day population name and place

Out of Africa Route
Into India and Peopling of Eurasia
Based on Recombinational Analysis

HUMAN IN AFRICA

Presence

KYP
250-300

Out of Africa

23-24/02/2016

BADAR AL-QAMASHOUI

AJHG
Volume 06, Issue 2, 10 February 2012, Pages 347-355

Report
The Arabian Cradle: Mitochondrial Relicts of the First Steps along the Southern Route out of Africa
Verónicas Fernández1,2, Farida Alishamal3, Marco Alves1, Marta D. Coats1,2, Joana B. Pereira1,2, Nuno M. Silva1, Lotfi Cherni1,6, Nourdine Herich6, Viktor Cann7,8, Pedro Soares1, Martin B. Richards2, 9, 11, Luísa Pereira1, 10, 11, 12
Neolithic Agricultural Revolution

Human in Africa
Out of Africa
Agriculture Revolution
And animal domestication

<table>
<thead>
<tr>
<th>Region</th>
<th>Species</th>
<th>Common name</th>
<th>Age of the oldest evidence of domestication (years BPE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Asia</td>
<td><em>Hordeum vulgare</em></td>
<td>Barley</td>
<td>10 500</td>
</tr>
<tr>
<td></td>
<td><em>Triticum turgidum</em></td>
<td>Emmer Wheat</td>
<td>10 500</td>
</tr>
<tr>
<td></td>
<td><em>Cicer arietinum</em></td>
<td>Chickpea</td>
<td>9 500</td>
</tr>
<tr>
<td>Africa</td>
<td><em>Sorghum bicolor</em></td>
<td>Sorghum</td>
<td>8 000(^{a})</td>
</tr>
<tr>
<td></td>
<td><em>Pennisetum glaucum</em></td>
<td>Pearl Millet</td>
<td>?(^{(1)})</td>
</tr>
</tbody>
</table>
Emersion of Ancient Civilizations

- Out of Africa
  - Human in Africa
  - Agriculture Revolution and animal domestication
  - Ancient Civilization
  - Presence

KYP
- 250-300
- 70
- 12
- 5.5
Maritime Era

Agriculture Revolution
And animal domestication

Ancient Civilization
Maritime and Trade

 Presence

Human in Africa
Out of Africa

KYP
250-300
70
12
5.5
5

Secrets of world's oldest boat are discovered in Kuwait sands

By Richard Weekes in Kuwait
12:00AM BST 01 Apr 2001

A BRITISH team of archaeologists believes that small slabs of bitumen dug up in Kuwait could hold evidence that man first successfully built ocean-going boats up to 7,000 years ago.

The bitumen pieces, dating from 5,000bc, are indented on one side by impressions of reeds and encrusted with barnacles on the other. The team, led by Robert Carter, from University College London, made the discovery while unearthing a Neolithic human settlement at Subiya, on the northern shore of Kuwait Bay, at the top of the Gulf.

Dr Carter said: "From the point of view of early trade, and early
Expansion of Islam

Human in Africa
Out of Africa
Agriculture Revolution
And animal domestication
Ancient Civilization
Maritime and Trade
Islam Expansion and Arab migration
Presence

KYP
250-300
70
12
5.5
5
1.4

K.N. CHAUDHURI
TRADE AND CIVILISATION
IN THE INDIAN OCEAN
An Economic History
from the Rise of Islam to 1750

Cattle (Bos Taurus) domestication

Archaeological and paleoenvironmental evidence implies cattle sacrifices were commemorated with a ring of more than 42 cattle skulls and a stone platform buried by 6,400-year-old floodplain sediments. Associated with

Sampling
113 samples: 36 Omani, 27 Libyan (African taurine), 20 southern Indian (zebu), 30 Portuguese Friesian (Near East taurine)

Genotyping
11 microsatellite loci

#### Results

- Oman North
- India and Pakistan
- Oman South
- Ethiopia
- Europe Milk
- Europe Dual-Purpose
- Europe Beef

[Map showing the geographical locations mentioned in the results.]

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*BADAR AL-QAMASHOUI*  
*SQU, 23-24/02/2016*
Badar Al-Qamashouì, Kareema Alsinani, Salama Alhamidi, Osman Mahgoub, Hamza Babiker (2016) Taurine to North and Zebu to South; mtDNA Suggests Two Independent Dispersal Routs for Cattle in Oman (manuscript).

- **Materials and methods**
  - D-loop of mtDNA sequences (600 bp) for 49 Omani cattle were analysed
How the Chicken Conquered the World

The epic begins 10,000 years ago in an Asian jungle and ends today in kitchens all over the world

Once chickens were domesticated, cultural contacts, trade, migration and territorial conquest resulted in their introduction, and reintroduction, to different regions around the world over several thousand years. Although inconclusive, evidence suggests that ground zero for the bird’s westward spread may have been the Indus Valley, where the city-states of the Harappan civilization carried on a lively trade with the Middle East more than 4,000 years ago. Archaeologists have recovered chicken bones from Lothal, once a great port on the west coast of India, raising the possibility that the birds could have been carried across to the Arabian Peninsula as cargo or provisions. By 2000 B.C., cuneiform tablets from Mesopotamia refer to “the bird of Meluhha,” the likely place name for the Indus Valley. That may or may not have been a chicken; Professor Piotr Steinkeller, a specialist in ancient Near Eastern texts at Harvard, says that it was certainly “some exotic bird that was unknown to Mesopotamia.” He believes that references to the “royal bird of Meluhha”—a phrase that shows up in texts three centuries later—most likely refer to the chicken.
Sampling
207 local chickens (5 groups/ 11 populations).

PC R and sequencing
HVS-I were amplified (700 bp).

B. Al-Qamashou, A. Al-Ansari, H. Simianer, S. Weigend, O. Mahgoub, V. Costa, A. Weigend, N. Al-Araimi, A. Beja-Pereira (2016)
From India to Africa across Arabia: an mtDNA assessment of the origins and dispersal of chicken around the Indian Ocean Rim.
Submitted for publication.
Results and Discussion

Median-joining network of mtDNA D-loop haplotypes

Clades of Liu (Liu, et al. 2006)
Results and Discussion

Pie charts indicating the proportion of the predefined mtDNA clades in chicken groups across the Indian Ocean rim.
Results and Discussion
Goat domestication

Goat (Capra aegagrus hircus)
Multiple maternal origins and weak phylogeographic structure in domestic goats

Gordon Luikart*, Ludovic Gijelly*, Laurent Excoffier†*, Jean-Denis Vigne‡, Jean Bouvet*, and Pierre Taberlet*

*Laboratoire de Biologie des Populations d’Altitude, Centre National de la Recherche Scientifique, Unité Mixte de Recherche 5553, Université Joseph Fourier, B.P. 53, F-38041 Grenoble Cedex 9, France; †Genetics and Biometry Laboratory, Department of Anthropology, University of Geneva, CP511 1211 Geneva 24, Switzerland; and ‡Archéozoologie et Histoire des Sociétés, Muséum National d’Histoire Naturelle, CNRS ESA 8045, 55 Rue Buffon, F-75005 Paris, France

Edited by Henry C. Harpending, University of Utah, Salt Lake City, UT, and approved March 8, 2001 (received for review December 13, 2000)

➢ Methodology
406 pure indigenous goats from Africa, Eurasia (Near East). Sequencing HVI of the mtDNA (579-bp) DNA fragment and 1140 bp of cytochrome b

➢ Results
- 6 maternal lineages for goat
- Dispersal via Arabia or Sinai to Africa
➢ **Methodology**

Genotyping 107 samples, 17 microsatellite loci

➢ **Results**

High genetic diversity and clear structuring
Five Ovine Mitochondrial Lineages Identified From Sheep Breeds of the Near East

Jennifer R. S. Meadows,† Ibrahim Cemal,‡ Orhan Karaca,‡ Elisha Gootwine§ and James W. Kijas*,†

- Sampling
197 unrelated animals representing eight breeds from Turkey and one from Israel.

- Sequencing
A 1246-bp fragment (mtCR) encompassing part of the control region, tRNAPhe, and 12s rRNA (15,983–592), a 1272-bp fragment (cytB) of the cytochrome B gene (14,078–15,349)

- Results
- 5 maternal haplotypes for sheep
- Two major dispersal routs from origin of domestication to Africa
African Origins of the Domestic Donkey

Albano Beja-Pereira,¹,²* Phillip R. England,¹ Nuno Ferrand,²,³ Steve Jordan,⁴ Amel O. Bakheit,⁵ Mohammed A. Abdalla,⁵ Marjan Mashkour,⁶ Jordi Jordana,⁷ Pierre Taberlet,¹ Gordon Luikart¹

Genetic diversity of donkey populations from the putative centers of domestication

S. Rosenbom*, V. Costa*, N. Al-Araimi*, E. Kefena†, A. S. Abdel-Moneim†‡, M. A. Abdalla*, A. Bakhiet** and A. Beja-Pereira*††
African Origins of the Domestic Donkey

Albano Beja-Pereira, 1,2* Phillip R. England, 1 Nuno Ferrand, 2,3 Steve Jordan, 4 Amel O. Bakhiet, 5 Mohammed A. Abdalla, 5 Marjan Mashkour, 6 Jordi Jordana, 7 Pierre Taberlet, 1 Gordon Luikart 1

Sampling
Samples from 52 countries across the Old World

Sequencing
479 bp of the mtDNA control region., and 1140 bp of cytB.
Sampling
129 Samples from 8 countries in Asia and Africa, 15 microsatellite loci

Conclusion
As the first study using nuclear markers and samples belonging to domestic donkey populations from putative centers of origin and their wild counterpart (African wild ass), the obtained results point to populations from two geographic regions as possessing the highest genetic diversity values: northeast Africa and the Arabian Peninsula. Also on a finer scale, Sudan and Yemen are the two
General recommendations

✧ More attention to the local genetic resources in the Arabian Peninsula/region must be given on the bases of:
  ✧ Food safety and security
  ✧ Climate change
✧ More cooperation between scientists/ institutions *(consortiums?!!)*
✧ Enhance archaeological researches
✧ Publication, *not necessary in high IFJ*
✧ Organizing conferences/meetings on animal genetic resources conservation
Genesis of the Arabian animal species: Interaction of geography, history and climate

General recommendations

- Genomic, adaptation to harsh climate
THANK YOU