Characterisation of Genetic Diversity, Structure and Admixture of Dromedary Populations

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Outlines

• A brief history of dromedary camel

• Dromedary camel types

• Genetic diversity results

• Summary and future work
A brief history of dromedary camel
Domestication of Animals

Numerous animals have been domesticated by humans over the last 10,000 years in many parts of the world:

<table>
<thead>
<tr>
<th>Domesticated Animal</th>
<th>Wild Ancestor</th>
<th>Region of Origin</th>
<th>Date (Years ago)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>Wolf</td>
<td>many places?</td>
<td>13,000</td>
</tr>
<tr>
<td>Goat</td>
<td>Bezoar goat</td>
<td>Iraq</td>
<td>10,000</td>
</tr>
<tr>
<td>Sheep</td>
<td>Asiatic mouflon</td>
<td>Iran, Iraq, Levant</td>
<td>11,000</td>
</tr>
<tr>
<td>Cattle</td>
<td>Aurochs</td>
<td>Southwest Asia</td>
<td>8,500</td>
</tr>
<tr>
<td>Pig</td>
<td>Boar</td>
<td>Anatolia</td>
<td>9,000</td>
</tr>
<tr>
<td>Domestic fowl</td>
<td>Red jungle fowl</td>
<td>Indus Valley</td>
<td>4,000</td>
</tr>
<tr>
<td>Horse</td>
<td>Wild horse</td>
<td>Southern Ukraine</td>
<td>6,000</td>
</tr>
<tr>
<td>Arabian camel</td>
<td>Wild camel</td>
<td>Southern Arabia</td>
<td>5,000</td>
</tr>
<tr>
<td>Bactrian camel</td>
<td>Wild camel</td>
<td>Iran</td>
<td>4,500</td>
</tr>
<tr>
<td>Llama</td>
<td>Guanaco</td>
<td>Andean plateau</td>
<td>6,000</td>
</tr>
<tr>
<td>Water buffalo</td>
<td>Indian wild buffalo</td>
<td>Indus Valley</td>
<td>4,500</td>
</tr>
<tr>
<td>Ass</td>
<td>Wild ass</td>
<td>Northeast Africa</td>
<td>5,500</td>
</tr>
</tbody>
</table>

From Biozone powerpoint 'cultural evolution'
Importance of dromedary

In the Past

- Transport of humans and goods through deserts.
- Help in the expansion of civilizations (e.g. Roman Empire, Arab).
Importance of dromedary

Nowadays

• Multipurpose animal and source of food (milk and meat).
• Economic values: racing, tourism.
Importance of dromedary

In the future

• Dromedary products will increase.
• Dromedary may be revealed as sustainable livestock in regions suffering of desertification.
Dromedary camel types
Camel types in the Arabian Peninsula

A- Production camel

I-Desert camels
- Mahaheem
- Magatter

II-Beach camels
- Sofor
- Awarik

III-Hill camels
- Shual
- Sahlia

B- Racing camel

Omania

Hurra
## A- Production dromedary camels

<table>
<thead>
<tr>
<th>Type</th>
<th>Size &amp; Weight</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Almugaheem</td>
<td>Big size, 500 - 800 Kg.</td>
<td>Dark brown to black.</td>
</tr>
<tr>
<td>2- Almugateer</td>
<td>Big size, 480 - 700 Kg.</td>
<td>White</td>
</tr>
<tr>
<td>3- Alsufur</td>
<td>Big size, 500 - 700 Kg.</td>
<td>Light brown and dark yellow to brown</td>
</tr>
<tr>
<td>4- Alshual</td>
<td>Big size, 480 - 700 Kg.</td>
<td>Light brown.</td>
</tr>
</tbody>
</table>

### Desert camels

- **PHYSICAL MAP**
  - Saudi Arabia
  - United Arab Emirates
  - Yemen
  - Oman
  - Jordan
  - Iraq
  - Egypt
  - Iran
  - Algeria
  - Libya

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**Figure**: Map of desert camels distribution across the Middle East.
Shual
Sufur
A- Production dromedary camels

<table>
<thead>
<tr>
<th>Type</th>
<th>Size &amp; Weight</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Alsahlia</td>
<td>Moderate to big size, 350-600 Kg</td>
<td>Light brown</td>
</tr>
<tr>
<td>2) Alawarik</td>
<td>Moderate to small size, 250-500 Kg</td>
<td>White</td>
</tr>
</tbody>
</table>

II- Beach camels
Alawarik
## A- Production dromedary camels

<table>
<thead>
<tr>
<th>Type</th>
<th>Size &amp; Weight</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Alhadana</td>
<td>Moderate to small size, 250-500 Kg</td>
<td>Yellow to red</td>
</tr>
<tr>
<td>2) Alawadi</td>
<td>Moderate to small size, 250-450 Kg</td>
<td>Brown</td>
</tr>
</tbody>
</table>

![Camel Map](image)
Alhadana
### B- Racing dromedary camels

<table>
<thead>
<tr>
<th>Type</th>
<th>Size &amp; Weight</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Alomania</td>
<td>Small size, 250-350 Kg</td>
<td>Between light brown to light yellow</td>
</tr>
<tr>
<td>2) Alhura</td>
<td>Small size, 250-350 Kg</td>
<td>Light brown</td>
</tr>
</tbody>
</table>

[Map of the Middle East showing the distribution of camels]
Genetic diversity study
Dromedary range

- How is the genetic diversity distributed across its present day geographic range?

- What is the degree of genetic differentiation between these camel populations?

Kohler-Rollefson, 1993
Sampling

1120 individuals
21 countries
Methods

Microsatellite genotyping

Mitochondrial DNA sequences

ABI 3730 (Applied Biosystems) sequencer system
Results of Microsatellites: diversity and structure
Archaeological records
mtDNA results: network analysis

- 76 dromedary mtDNA haplotypes may be grouped into two distinct haplogroups

- Lack phylogeographic structure
Weak genetic differentiation among most of the dromedary populations

Consequence of: Globalization of dromedary diversity, Inter-continental trading networks with extensive back-and-forth movements lead to intense sharing of the genetic variations

Horn of Africa appear to be distinct

These results suggest that the domestic dromedary camels were introduced to the African continent via at least two entry points (Egypt and Horn of Africa)

Most of genetic structure is in the Arabian Peninsula
Future work
Advances in genotyping

Comparative genomics approaches
Scientific collaborations between universities, research centers, camel industries and governments
Conservation and Genetic Improvement center (CGIC)

International camel consortium for genetic improvement and conservation (ICC-GIC)
Acknowledgements

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Thank you