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The Encounter between Bactrian and Dromedary Camels in Central Asia

The two large domestic camelids, the one-humped dromedary (*Camelus dromedarius*) and the double-humped Bactrian camel (*Camelus bactrianus*), live in two distinct areas of the Old World. Their distribution areas overlap in a few countries such as Iran, India and Afghanistan, but the practice of hybridization is the most common in Kazakhstan. Indeed, despite being classified as two different species, the dromedary and Bactrian are interfecund.

Historically, the hybridization between the two species was associated with the Silk Road, and was aimed at producing animals combining the robustness of the Bactrian and the endurance of the dromedary, as well as an animal that was adapted to sharply contrasting climate. Nowadays, the objective is the improvement of milk production, the dromedary having a higher potential than Bactrian, but being less adapted to cold winters.

There are different forms of hybridizing, depending on the number of the hump of the genitor. Globally, in Kazakhstan, two patterns are distinguished: the *Kurt-nar* way (dromedary female x Bactrian male) and the *Kez-nar* (Bactrian female x dromedary male). Then two types of cross-breeding are carried out: by absorption or alternated. The hybridizing has important consequences on the behavior and physiology of the animals.

KAZAKHSTAN, A STEPPE COUNTRY

History and geography have meant that livestock has a central place in the culture and economy of Kazakhstan, even if the industrial developments related to the political changes of the 20th century reduced its the relative importance. With a territory of 2.7 m sq. km, Kazakhstan ranks as the ninth largest country in the world. Located in the heart of Central Asia and mainly composed of steppes (80%), with only 16.7 m inhabitants it has a very low population density and a large area of agricultural activity, with livestock mainly reared extensively. If cows are reared in the most favorable areas, sheep, horses and camels occupy the most remote places. Indeed, the country is marked by its wide open spaces, mainly semi-arid, where camels are the best animal to exploit them.

The particularity of camel in Kazakhstan is that the Bactrian and the dromedary cohabit in the same areas, even sometimes on the same farm. Elsewhere, there is widespread hybridization between these two species. This practice has been common for very long time in the history of the central steppe, probably beginning under the Parthians about 2200 BCE (Bulliet 1975). This paper focuses on current hybridization practices in Kazakhstan.

THE PLACE OF THE CAMEL IN CURRENT KAZAKH SOCIETY

Camel stocks are marginal compared to the total livestock population in Kazakhstan (table 2) and represent only 3.4% of the domestic herbivorous biomass (DHB) at national level. But it has a dominant presence in steppe area and it contributes to the exploitation of the most remote areas of the country.

There was a dramatic fall in the camel population, as there was for all other livestock, after the collectivization of agriculture. Moreover, according to the Stalinist ideology, the traditional nomadic way of life was not compatible with the modernization of the rural economy in social-

ist society, leading the camel farmers to be settled. These events occurred in the years 1927–1932 and led not only to the death of the third of Kazakh population and to the total destruction of the former spatial organization, but also to the dramatic fall in the livestock population, especially among animals used by the nomads, i.e., sheep, horses and both kinds of camel, leading to a famine that intensified the effect of the collectivization by killing 1.3 million people mainly in the steppe areas (Ohayon 2006).

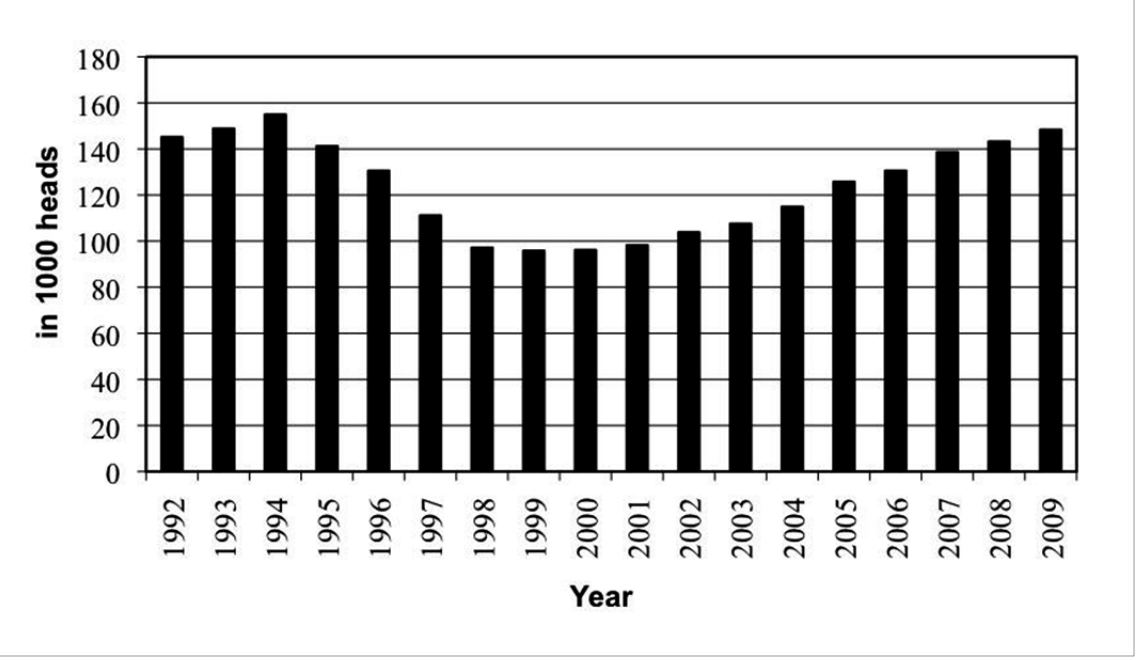
Live animals	**Herbivorous Stock**
Sheep	13,300,000
Cattle	5,840,000
Goat	2,600,000
Horse	1,300,000
Camel	145,000

Table 2: Livestock population in Kazakhstan for the year 2008 (source, FAOstat)

In these conditions, the sheep population fell from 18 m to 12 m and the horse from 3.5 m to 0.8 m. The camel population, for its part decreased 10 times, from 1.2 m in 1927 at the beginning of the "modernization" to less than 120,000 in 1940. This drastic change in the camel population was accompanied by an end to mobility, the camel being considered as an animal of the past, unlike the cow, which was seen as the animal of the modern farms.

However, at the same time, science-based agronomic research started in various institutes and universities, in order to promote the scientific development of agriculture and livestock.

After the crisis linked to collectivization, the camel population remained stable for the rest of the Soviet period. However, in recent decades, after a new fall linked to the privatization of collective agriculture, the camel population is now in a growth pattern (see graph 5) and the current population has regained the level it was at just after independence. The Bactrian camel makes up approximately 90% of the total camel population, but the dromedary population is increasing in the southern part of the country.



Graph 5: Trends in the camel population in Kazakhstan since 1992 (source FAOStat)

ECOTYPES OF CAMELS IN KAZAKHSTAN

Since the 19th century the Kazakh Bactrian breed has been distinguished by traditional local selection aiming to choose the more "enveloped" animals (taller and with higher wool productivity for a better resistance to the cold) for reproduction. In this population, three Bactrian phenotypes are described according to their size, their stoutness and their productivity: *Oralbokeilik, Kyzylorda, Ongtüstik-Kazakhstan.* In addition, the dromedary was imported over a longer period to produce various hybrids.

ORALBOKEILIK – THE TALLEST BACTRIAN CAMEL

This type is mainly concentrated in steppe zone in western Kazakhstan and in sandy regions in *Atyrau oblys* (an administrative region in Kazakhstan). Its population, 34.7 thousand head, is increasing. Selection to define the standard type and establish pedigree is carried out on special "pure breed" farms, which receive specific subsidies from the Ministry of Agriculture. The numbers on these farms can represent up to 8% of the total camel population of the *oblys*. This type is the tallest of the Kazakh breeds (2 m high and weighing up to 900 kg) with a coat of long, yellow-brown hair and a characteristic mane, beard and "hairy short trousers". The aim of the selection is the improvement of wool and milk production (see picture 3).

KYZYLORDA – A MEAT-PRODUCING CAMEL

Mainly found in the *Kyzylorda oblys* and around Aqtobé city, the Kyzylorda camel population increased from 29,900 to 41,400 between 1998 and 2006. Approximately 9% are considered pure breed and selected in specific farms. They are compact, stocky animals, 185 cm high (female) to 190 cm (male) and not exceeding 750 kg. The hair coat is darker than the previous breed, but with similar distribution on the body. The main purpose of selection is for meat production (see picture 4).

ONGTÜSTIK-KAZAKHSTAN – THE BEST MILK PRODUCER

Well distributed in Almaty, Jambyl and south Kazakhstan, this type has experienced an important demographic increase since 1998 (from 40% to 70% according to the *oblys*). The pure breed represents 5% of the whole camel population. The animals are stockier than the previous one: 170–184 cm in height and 600–700 kg in weight. The coat is yellowish or light brown with shorter fibers. The selection aims to improve growth and the wool production (see picture 5).

DROMEDARY

The only dromedary breed in Kazakhstan is the *Arvana*, a Turkmenistan originate. They are numerous in the southern part of the country where they can be considered the most northern distribution of the dromedary in the world. Their numbers are increasing. The *Arvana* dromedary has a unique, long hump rather toward the back. They are big animals (185–195 cm in height, 600–650 kg in weight) sometimes with exceptional weights of more than a ton in the male (Cherzekov/Saparov 2005). They have high milk productivity and are used for hybridizing in order to improve milk production of the Bactrian breed (see picture 6).

HYBRIDS

Hybridization has long been common in the Kazakh steppe. Bactrian and dromedary camel often cohabit within the same farm (see picture 7) and there are a wide number of types of crossing (Bactrian male or female x dromedary female or male) (see table 3). These hybridizations produce a high heterosis effect for milk, meat and wool production (see picture 8). For example, the live weight of the female Iner-Maya (F1) is 128% higher than the dromedary dam, and the

wool productivity increased 192% compared to the pure dromedary breed. The milk production is 69% higher than the Bactrian and even slightly higher (2%) than the dromedary. In a within-farm comparison, a difference in the milk composition has also been observed, the hybrids being intermediate: Bactrian milk had higher concentration in vitamin C and minerals, a higher fat content but lower long-chain fatty acids (Faye et al. 2008, Konuspayeva et al. 2008).[1]

After crossing the pure parental species to breed the first generation (the so called F1-generation), there are two ways of hybridization:

- Alternate crossing pathway to maximize the heterosis and increase milk production (dromedary effect), fatty matter (Bactrian effect), wool productivity (Bactrian effect) and cold (Bactrian effect) or heat (dromedary effect) resistance.
- Absorption crossing pathway for easier animal management, the hybrids, especially F2-generation Jarbai type being very difficult to rear (animals with a bad character, weak progeny or poor conformity). Absorption crossing leads to pure-breed animals after three generations (see table 3).

Type of hybrid	**Kazakh name of ♂ product**	**Kazakh name of ♀ product**	**Generation rank**
♀ Bactrian x ♂ dromedary	Nar	Nar-maya	F1
♂ Bactrian x ♀ dromedary	Iner	Iner-maya	F1
Nar x Nar-maya	Jarbaï	Jarbaï	F2 50/50
Nar or Nar-Maya x Bactrian	Bal-Kospak	Bal-Kospak	F2 75B/25D
Bal-Kospak x Bactrian	Myrza-Kospak	Myrza-Kospak	F3 87.5B/12.5D
Myrza-Kospak x Bactrian	Bactrian	Bactrian	F4 93.7B/6.3D
Nar or Nar-Maya x Dromedary	Jun	Jun	F2 75D/25B
Jun x dromedary	Kurt	Kurt	F3 87.5D/12.5B
Kurt x dromedary	Dromedary	Dromedary	F4 93.7D/6.3B
♀Bal-Kospak x ♂ Dromedary	Kez-Nar	Kez-Nar	F3 50/50
♀ Kurt x ♂ Bactrian	Kurt-nar	Kurt-Nar	F3 50/50

Table 3: Main hybridization scheme achieved between Bactrian and dromedary camel in Kazakhstan

THE USE OF CAMELS IN KAZAKHSTAN AND THE PLACE OF HYBRIDS

By order of economic importance, camel products in Kazakhstan are milk, meat and wool. The camel is rarely used for riding and its role as a draught animal in agriculture is completely marginal.

THE VALUE OF CAMEL MILK

In Kazakhstan, where animals live in vast empty spaces, the possibilities of keeping products fresh are rare, so farmers have traditionally marketed fermented products. Fermented camel milk is called *shubat*, *kurt* is a dehydrated product close to camel cheese, and there is a caramelized dessert known as *balkaimak*. These products, and especially *shubat*, are typical of the country and can be considered as "territory products", indicating a cultural identity stemming from

[1] For the discussion on the flip-side of the coin of hybridization, namely the threat to wild camel populations, see the article by Katja Silbermayr in this volume.

ancestral techniques and forming an important part of the tradition. This rooting in the traditional culture could be a strong commercial argument.

For the moment, most *shubat* production is small-scale, but the industrial sector for fermented camel milk is increasing in spite of the lack of standardization in production and processing conditions (Faye and Konuspayeva, 2008).

Camel milk is appreciated for its medicinal properties: anti-carcinogenic (Magjeed 2005), hypo-allergic (Shabo et al. 2005) and anti-diabetic (Agrawal 2003). A high level of unsaturated fatty acids contributes to its overall dietary quality (Karray et al. 2005, Konuspayeva et al. 2008) and more generally it is used as an energy drink for convalescents. Its anti-bacterial effects are commonly used in treating infectious diseases such as tuberculosis and the *shubat* cure has long been recommended in sanatoria (Sharmanov/Servetnik-Chalaya 1983). Patients showed a significant improvement and a restoration of blood parameters with two liters of *shubat* per day for two to four months. Similar results were reported in Libya with 1.5 l/day (Alwan/Tarhuni 2000) and in India with 1 l/day (Mal et al. 2000).

The milk for Kazakh consumers comes both from Bactrian and dromedary camels. As mentioned above, on average, dromedaries produce far more milk than Bactrians. To give just a few references (Faye 2004), the production potential for Bactrians was between 650 and 2000 liters per 12-months lactation while the dromedary Arvana breed could produce up to 6000 liters over the same period (Cherzekov/Saparov 2005). Consequently, the main reason for hybridization today is the improvement of milk production. The discriminant parameters in milk composition of Bactrians, dromedaries and hybrids are vitamin C, total protein, pH, phosphorus, calcium, iodine index and fat matter. In hybrids, vitamin C concentration is close to that in Bactrian milk, for fat matter it is close to dromedaries (Faye et al. 2008). Both the productivity as well as the quality assessed by fat content can vary according to the form of hybridization (table 4).

Type of animal	Scheme of hybridation	Live weight (kg)	12-mth milk production (L)	Fat matter of milk (%)	Wool productivity (kg)
Bactrian		610	1750	5.8	6.0
Nar-maya	♀ Bactrian x ♂ dromedary	670	2955	4.6	4.9
Iner-maya	♂ Bactrian x ♀ dromedary	605	3563	3.5	3.5
Kospak	Nar-Maya x Bactrian	643	1925	4.6	5.2
Kurt	Iner-Maya x Dromedary	535	2544	4.1	3.2
Kez-Nar	Kospak x Dromedary	650	3875	4.6	5.0
Kurt-Nar	Kurt x Bactrian	640	4565	4.5	3.7
Dromedary		557	4000	3.5	3.1

Table 4: Dairy production, fat matter and wool productivity of Bactrian, dromedary and their hybrids according to the type of hybridization (Terentjev 1975)

The quantity and quality of the milk is influenced by the breed of the mother (Terentjev 1975). If the mother is Bactrian, the milk production of F1 is lower but fat content significantly higher than hybrid F1 with dromedary mother (table 4).

CAMEL MEAT AND WOOL

Meat and wool can be considered as by-products of the milk production. The live weight of the Bactrian is on average higher than the dromedary and the hybrids can be heavier than their parents, depending on the breed of the father (table 4). Camel meat consumption is not very popular except in rural areas. Since the camel meat sector is not well organized and the main purpose of camel farming is milk, the meat market mostly uses old culled females, i.e. low quality meat that does not appeal to urban consumers. To our knowledge, unlike for milk there is no data on the difference in camel meat quality between the Bactrian and the dromedary.

The wool productivity of the Bactrian camel, an animal well adapted to the cold, is considerably higher than the dromedary. As with meat, despite the relatively good wool quality of Bactrian fur, the camel wool sector in Kazakhstan is not well organized and the commercial exploitation of this product is low compared to countries such as Mongolia, where cashmere camel wool is well developed (breed selection, modern wool-processing technology).

CONCLUSIONS

Kazakhstan is one of the main places in the Old World where the geographical distribution of the two camel species overlaps. The country was also important milestone on the Silk Road where the caravans from China using Bactrians met those from Persia using dromedaries. This meeting facilitated the hybridization practices. At that time, the hybridization was mainly used to produce stronger pack animals (Wilson 1984). In modern Kazakhstan, the demand for milk is increasing and the hybrids could again play a certain role in supplying higher milk quantity with better quality in the cold desert of Central Asia.

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