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Erforschung biologischer Ressourcen der Mongolei
/ Exploration into the Biological Resources of
Mongolia, ISSN 0440-1298

Institut für Biologie der Martin-Luther-Universität
Halle-Wittenberg


2007

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Gertrud Neumann-Denzau
Panker, Germany, denzau@t-online.de

Helmut Denzau
Panker, Germany

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Neumann-Denzau, Gertrud and Denzau, Helmut, "Remarks on the Social System of the Mongolian Wild Ass (*Equus hemionus hemionus*)" (2007). *Erforschung biologischer Ressourcen der Mongolei / Exploration into the Biological Resources of Mongolia, ISSN 0440-1298*. 84.

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Erforsch. biol. Ress. Mongolei (Halle/Saale) 2007 (10): 177-187

Remarks on the social system of the Mongolian wild ass (*Equus hemionus hemionus*)

G. Neumann-Denzau & H. Denzau

Abstract

So far the social system of Mongolian wild asses is non-uniformly interpreted. The authors describe their own observations from different parts of Mongolia and review data from available publications. The arguments support a territorial social system, which agrees with the social system of all other wild asses in Asia and Africa.

Keywords: Mongolian wild ass (*Equus hemionus hemionus*), social system, behaviour

Introduction

The Mongolian wild ass (*Equus hemionus hemionus*, Pallas 1775) was named Dshikketaei (Latin), Dshiggetai (German), Dshiggetei, and Chigetai (English) by Pallas himself. The spelling Dziggetai, commonly used in works written in English today, was introduced by LYDEKKER (1904). The Mongolian wild ass was recently called also Khulan (Mongolian) by some authors, not to be confused with Kulan, the Turkmenian wild ass (*Equus hemionus kulan*) in particular; this term is used in general for the Asiatic wild ass (*Equus hemionus*) in Russian publications.

Formerly, Mongolian wild asses were distributed from the southern Dzungarian Gobi in China and the northern Dzungarian Gobi in Mongolia (in the southwest) to the three-way border between Mongolia, China and Russia (in the northeast) with an extension towards the Lake District in Mongolia (in the northwest). Today they are confined to a belt from the northern parts of the Dzungarian Gobi, across the central to the South Gobi in Mongolia (including an extension to the southeast), with perhaps a few across the border in China. The majority of the Mongolian wild asses lives in protected areas, particularly the Kalamaili Nature Reserve in China and in Mongolia (from west to east) the Great Gobi-B and Great Gobi-A Strictly Protected Areas, the Gurvansaikhan National Park, and the Small Gobi-A and Small Gobi-B Strictly Protected Areas.

The Mongolian wild asses suffer interference from livestock in sparse desert vegetation and limited water resources. Furthermore poachers persecute them. For the implementation of conservation measures and for monitoring the population it is important to understand the population structure and dynamic. Social organisation is a key to this understanding.

Equid species exhibit one of two different basic types of social system, either the territorial system or the non-territorial system (KLINGEL 1974, 1975, 1977).

The individuals in the territorial system are found either as a solitary stallion, in unstable associations of mares, sub-adults and foals, or in unstable all-male bachelor groups. Only a mare and her young foal form a unit of some permanence and may be seen apart. There is no dominance hierarchy among adults. The size of mare associations and bachelor groups is variable.

The individuals in the non-territorial system are found either in a band, consisting of usually one stallion, several mares, sub-adults and foals, or in a bachelor group. Both units are long-lasting and stable with a dominance hierarchy among the members. Solitary stallions or solitary mares with a foal are not normally encountered.



Fig. 1: Solitary stallion overlooking his territory distant from any water hole in the South Gobi. (photo: G. & H. DENZAU).



Fig. 2: Lone mare with young foal roaming far from other conspecifics in Great Gobi B (Dzungarian Gobi); photo: G. & H. DENZAU.

Own observations

Here we summarize our observations from the years 1992, 1993 and 1996 regarding the social system of the Mongolian wild ass as described in detail in DENZAU & DENZAU (1999).

Gobi-B

In 1992 we observed wild asses in the surroundings of the salt swamp Chonin Us (from 6th – 14th August). We counted about 350 animals in and around this oasis, which provides food and water. On the central pastures with high vegetation cover the asses lingered close together at such high density that it was difficult to understand their interrelationships. This was more easily visible when they came down in small groups from the surrounding hills for grazing and drinking or when leaving the area. Groups of mares and foals could be distinguished clearly from bachelor groups. Outside Chonin Us we noticed solitary stallions spaced at intervals; in fact we had set up our tent unwittingly on one of their large territories. Towards the swamp the spacing between the solitary stallions decreased, meaning that their territories became smaller towards the centre of the wild ass congregation. The following observation will clarify the system: on one occasion a single mare moved together with her young foal from the desert in the north towards the swamp. A stallion rushed to meet and accompany her. She did not stop, but continued single-mindedly, while he followed on her heels. A few minutes later another stallion came running towards her. The first stallion immediately turned round and let her go. Obviously she had just left his territory when the second stallion approached.

Gobi-A

In 1993 we visited the Transaltai Gobi between 17th and 27th September. During a drive of 598 km we saw 115 wild asses in 24 groups, with a mean group size of 4.8 (range 1-19, SD 5.5, median 2). The largest group with 19 animals was a bachelor group; 10 solitary animals were believed to be territorial stallions (9% of all animals).

South Gobi

In June 1996, on the way to the south, the first solitary stallion was seen at 103.8° E, 43.2° N, an indication of the northern distributional boundary. A first concentration of 300-400 animals was observed in the wide area surrounding Tsagan Tolgai (103.7° E, 43.0° N), a place with several small water holes in a dry riverbed. Overnight at the easternmost watering place the voices of the wild asses, loud and hoarse, indicated that there was lively nocturnal activity. In the early morning between 5:30 a.m. and 9:00 a.m., nine mares with five yearlings and five solitary stallions appeared at the spring. Afterwards domestic camels occupied the water and prevented wild animals from coming to quench their thirst. The next day another hideout with view towards a cluster of water holes a few hundred meters further west was chosen. Again, domestic camels throughout the day obstructed the water holes most of the time. When they left in the evening about 40 wild asses including eight young foals came to drink before nightfall. The mares and foals approached in small units, usually of one to three animals, unaccompanied by any stallion. The association of the mares turned out to be unstable. Animals that came together left independently in different directions after drinking, and showed no ties. The mares and foals of an unusually big group of 14, which came to drink led by a pregnant mare, did not stay together either. Sometimes single stallions drove mares in front of them towards the water, but showed no permanent bonding. We assumed that many of the solitary stallions hold a territory at another place and came here only for drinking.

Detailed observations

Detailed observations regarding the dominance behaviour of different stallions around the spring were made at Tsagan Tolgai from 29th June until 1st July 1996. The stallions in question could be recognized individually by certain anomalies such as scars and spots, characteristics such as the appearance of the tail, mane and ears, details of body coloration, size and shape of chestnuts, presence of hoof rings, and sometimes physiognomy and stature. We assessed dominance among stallions by rating the time spans, during which a stallion drove away other stallions – whether bachelors in groups or single males – and persecuted mares. Stallions standing about or coming exclusively for drinking were not rated as dominant.



Fig. 3: Individual mare with young foal approaching the water hole at Tsagan Owor (South Gobi); photo: G. & H. DENZAU.



Fig. 4: Stallions fighting for dominance over a temporary territory at the water holes at Tsagan Tolgai (South Gobi); photo: G. & H. DENZAU.

Table 1: Dominance times of different stallions at the spring Tsagan Tolgai

(..... = observation break or disturbances, --- = times without a dominant stallion
 D = way of taking over dominance, C = time of copulation, S = stallion)

Date	Time span	Dominance	Remarks
29.06.1996	15:00 - 17:30	
	17:30 - 19:00	-----	
	19:00 - 20:30	stallion 1	D: short fight S1 + S2
	20:30 - 21:00	stallion 2	
	21:00 - 21:20	-----	
	21:20 - 22:00	stallion 3	
	22:00	
30.06.1996	05:30 - 07.30	-----	
	07:30 - 08:30	stallion 3	C: 8:30
	08:30 - 14:00	-----	
	14.00 - 14:20	stallion 4	
	14:20 - 14:30	-----	
	14:30 - 15:30	stallion 5	D: chased away by S6
	15:30 - 18:45	stallion 6	C: 16:30, 17:10, 18:40
	18:45 - 18:50	stallion 6 + 2	D: fight S6 + S2
	18:50 - 21:20	stallion 2	C: 19:15
	21:20 - 21:30	stallion 2 + 7	D: bloody fight S2 + S7
	21:30 - 22:00	stallion 2 + 7	sharing the area
	22:00	
	01.07.1996	05:45 - 06:55	stallion 2
06:55 - 07:30		stallion 2 + 7	sharing the area
07:30 - 09:00		stallion 1	D: without fight
09:00 - 10:15		-----	
10:15 - 10:30		stallion 8	
10:30 - 14:30		-----	
14:30 - 15:20		
15:20 - 17:20		-----	
17:20 - 18:45		stallion 8	D: chased away by S2
18:45 - 21:30		stallion 2	
21:30		

Table 2: Times of dominance of particular stallions, frequency of presence (in brackets), and number of copulations at Tsagan Tolgai as listed in table 1

Stallion No.	Times of dominance	Frequency	Remarks
stallion 1	3:00 hours	8.4 % (2 times)	
stallion 2	8:15 hours	23.0 % (6 times)	1 copulation
stallion 3	1:40 hours	4.6 % (2 times)	1 copulation
stallion 4	0:20 hours	0.9 % (1 times)	
stallion 5	1:00 hours	2.8 % (1 times)	
stallion 6	3:20 hours	9.3 % (1 times)	3 copulations
stallion 7	1:15 hours	3.5 % (2 times)	
stallion 8	1:40 hours	4.6 % (2 times)	
without stallion	16:45 hours	46.6 % (8 times)	
double occupancy	- 1:20 hours	- 3.7 %	
total	35:55 hours	100.0 %	observation time



Fig. 5: Mating with holder of a temporary territory near the water holes at Tsagan Tolgai (South Gobi); photo: G. & H. DENZAU.



Fig. 6: Mating with holder of a temporary territory near a water hole at Tsagan Owor (South Gobi), photo: G. & H. DENZAU.

Analysis of these observations shows the following picture: for about half of the observation time (53.6 %) the area around the spring was controlled by stallions alternating in dominance. In three days eight different dominant stallions could be identified with a mean residence time of 1:22 hours (SD 0:58 hours, range 0:20-3:20 hours). Stallion 2 controlled the spring most often, altogether 8:15 hours (23.0 % of the observation time). This implies that the stallions at Tsagan Tolgai acquired a temporary territory, defended the area, eventually copulated here, and afterwards left it to another stallion, or unoccupied. Such a style of copulation behaviour has not been documented previously. The size of this temporary territory was about 0.2 km².

When we returned on 10th July 1996 for a last visit to Tsagan Tolgai (observation time 9:30–20:00), the situation had changed. The small water holes were now more productive because some rain had fallen during the previous days. The animals seemed to be less thirsty and the situation was more relaxed. No dominance among stallions could be recognized. Different stallions went straight to drink and paid no attention to each other or to the mares. The mares and their offspring, when they came down to drink stayed for only a short time, in contrast to the situation ten days before. No copulations occurred. We assume that the phenomenon of changing dominance among stallions is connected with the long-lasting presence of waiting mares caused by the shortage of water when it was blocked by domestic camels, and/or with the oestrous of the mares. Perhaps the stallion, in order to be able to mate, has to demonstrate his ability to hold a territory, whether long-term or short term.

The defence of a temporary territory by different stallions was not a singular incident but was also found at Tsagan Owor (104.1° E, 42.3° N). Here, four different dominant stallions alternated over two days (3rd - 4th July 1996), during 20 hours of observation time. One of these stallions ceased his dominance behaviour when the females had left and only males approached. He received them with excited calls, but without chasing or aggression, and was evidently in a position of equality with them.

A more typical territorial system of the Mongolian wild ass could be observed on July 7th 1996 south of Tolin Dzadgad, east of the spring Bor Hatchiwch (104.5° E, 42.8° N). Looking down from the hills onto the flat desert steppe, we observed an impressive clustering of 300-400 wild asses. The observations clearly showed the territorial social system in operation: In the centre of the congregation (lek) stallions defended very small territories, identified by the behaviour of neighbouring stallions when the mares travelled through. The mares showed no cohesion, but moved around independently. The stallions often made efforts to hold them back by forcing a change of their direction when the mares intended to leave them. Other stallions tried in their turn to drive the mares towards their own territories before they had left the neighbours' territories of their own free will. At the margins of the lek, solitary stallions stood at greater distances apart, implying larger territories. In the centre of the congregation in particular, we observed numerous mating attempts, and some stallions were fighting. Stallions from the outer areas that tried to move towards the centre of the lek were vehemently driven back with loud calls by the more central stallions. The activities of driving and chasing in the open landscape took place over a limited area of about 3 km in diameter; here was a high local density of 42-57 asses/km². Not much is known so far about the size or the number of territories, as well as the temporal and spatial permanency of such big congregations. It could not be ascertained if the territories within the leks were visited by the females solely in search of feeding resources ("Mating territories") or if they were mainly established by the stallions to attract females in oestrous ("Clustered Mating Territories"), or were of an intergraded type, as differentiated by CLUTTON-BROCK (1989).

Observations by various authors

Until the 20th century only one kind of social system was known for the equids, the non-territorial or harem system as found in domestic horses. Most observers took this model as a basis when observing other equids like wild asses. Regardless of their beliefs and interpretations, some authors

did nevertheless unwittingly notice strong or definite indicators for a territorial social system in the Mongolian wild ass. Reports in this context are outlined in what follows, in chronological order.

RADDE (1861), in his account from southern East-Siberia, mentioned that the young dziggetai stallions separate from the herd in their 3rd or 4th year. Towards autumn they are found solitary in the hilly steppes, where they stand for hours and hours on a hillock and wait pugnaciously for the approach of a herd to attack its leader. RADDE heard that Tungus hunters prefer to stalk such solitary stallions in a head wind on stormy days; sometimes they lie in ambush behind a horse and wait for a wild ass stallion to mistake it for a mare of his own kind.

The Russian zoologist GRUM-GRIJIMAILO observed during his travels in Dzungaria in 1889-90 both Przewalski horses and Mongolian wild asses, and noticed remarkable differences in the behaviour of groups and stallions (GRUM-GRIJIMAILO 1891, SALENSKY 1902). He saw the wild horses usually walking one behind the other, especially when taking to flight; the stallion never led the herd but always remained behind, taking care of the young, which he protected better than the mares did, and only in case of danger when the herd contained no foals would he rush in front, and then ran aside with an extraordinary restlessness in all his activities. The wild asses on the contrary always crowded together in a bunch and ran away in confusion when frightened; the stallions behaved more egotistically and took little care of the mares and foals.

The American zoologist ANDREWS made some remarkable observations of Mongolian wild asses on his expeditions to the South Gobi in 1922/23 and 1925. He noticed solitary stallions, mares and offspring without stallions, and very big associations. ANDREWS (1933) "They gather into herds, largely composed of mares, just before the young are born. The stallions do not entirely leave them but remain somewhat separated. Later in the summer many of the males range by themselves. The solitary individuals which we saw were invariably stallions." Standing on the edge of a wide, shallow depression he saw at least thousand wild asses: "They were massed in three dense groups on the valley floor, and for miles the horizon was dotted with stragglers. (...) On the way back to camp we saw four more asses – two mares, each with a colt." He estimated that colts at this time of the year (July) were not more than a week or ten days old. A solitary stallion not more than a mile and a half from camp was observed: "He was drowsing in the sun and stood absolutely motionless except for an occasional flick of his tail and lazy movements of his long ears".

KLINGEL (1977) was the first who analysed ANDREWS' descriptions regarding the social behaviour of the dziggetai: "The reports of ANDREWS (1933) on Mongolian wild asses can be interpreted as supporting the idea of territoriality."

BANNIKOV (1975, 1981), during an 800 km survey of the Transaltai Gobi in August 1974, observed that 16.4 % (25 of 152 dziggetais) were solitary animals. BANNIKOV (1971) wrote: "At rutting time solitary males are often encountered, generally those who are attempting to mate for the first time." He also noticed mares apart from groups: "Those of the females with newborn foals leave these groups for a short while at the beginning of the summer".

CHU et al. (1985) counted 358 Mongolian wild asses in 73 groups during an aerial survey of the Kalamaili Mountains Reserve in Xingjiang, China (west of the Mongolian Gobi-B) in July 1982. 18 of these groups consisted of single wild asses (group size one), meaning that 5.0% of all animals were found solitary.

Because FEH et al. (1994, 2001) have done so far the most comprehensive investigations of the social system of the Mongolian wild asses in Gobi-B, an outline of their conclusions is given here, including those that on the face of it do not conform with a territorial social system.

Solitary stallions observed by them were not listed separately but placed in the data analysis among the all-male groups with group size one. FEH et al. (2001) summarized their observations between 1992 and 1996 in Gobi-B as follows: "Khulans of this subpopulation unlike other Asian and African wild asses, form year-round stable, non-territorial families. These families and

all-male groups join together into “bands” in winter, and herds of several hundred animals, where reproductive rate is highest, form throughout the year. (...) We observed more small (1-10 individuals) in summer and more medium-sized groups (from 11-50 individuals) in winter. The number of large groups (50-850) did not vary between seasons. Small sized groups usually consisted of stallions only or families of stallions, mares and young animals. (...) Over the 5 years, we met all-female groups only four times. (...) We never saw solitary stallions in winter. (...) The observed three-level society in this khulan population reveals a complexity of social organisation unheard before in any ungulate. (...) Khulans have developed an elaborate anti-predator defence strategy through group formation.” FEH et al. defined a group as being when its diameter was less than the distance between two groups and members showed coordinated movements during an observation period, usually for more than four hours. Their statements resulted in a controversial interpretation of the social system.

READING et al. (2001) recapitulated the occurrence of solitary Mongolian wild asses (group size: one) in Gobi-A, Gobi-B, South Gobi and South-eastern Gobi.

KACZENSKY & WALZER (2002), doing research on Przewalski horses (takhis) and Mongolian wild asses in Gobi-B, wrote: “In contrast to takhi, khulan do not live in distinct harem groups, but live in large herds of changing composition. The only stable unit is the mare with her foal. Stallions occupy small temporary territories, especially near water holes, where they wait for mating opportunities with females in oestrus passing through.” KACZENSKY & WALZER (2003) visited Gobi-A between the end of June and the beginning of July 2003: “During our ~400 km trip through the western part of Gobi-A we only came upon 5 single khulan and 2 small khulan groups of 6 and 3 animals, respectively”, that is 35.7% solitary dziggetais (5 out of 14 individuals).

STUBBE et al. (2005) speaking of wild asses in the South Gobi, wrote: “In 2001 some hundred animals were observed in the area of the Bordzongiyn Gobi, but in the same season in 2002 and 2004 as well as in autumn 2003 there were only single animals or, very rarely, small groups.” Stubbe (2005) confirmed frequent sightings of solitary stallions in the South Gobi, less shy than other dziggetais.

During a line transect survey of the Gobi-B in July 2004, LIPP (2005) found 11 solitary standing adults (11.2 %) among 98 wild asses in smaller groups plus larger groups of 300, 150, 300 and 50 animals. By way of comparison, there were no solitary individuals among the free-roaming Przewalski horses in Gobi-B at any time period between 2001 and 2005 as reported by KACZENSKY & WALZER.

Discussion

Sightings of solitary adult Mongolian wild asses, most often stallions, have been reported by almost every author, although not all of them realized this as an indication for the territorial social system. Mongolian wild ass mares with their newborn foals were found isolated. This happens apparently only in the territorial social system to avoid contacts with too many passing conspecifics in the first hours or days after delivery, not within the stable and size-limited bands in the non-territorial system (NEUMANN-DENZAU 2007).

The recognition of unstable small groups of females with or without offspring and other constellations of changing composition is mainly due to our own observations in Gobi-B and South Gobi, near water holes as well as in congregation areas.

The distribution of Mongolian wild asses is non-uniform, with irregular massing in particular areas consisting typically of 300-400 animals, sometimes up to 2-3 times more. This fact renders uncertain any population estimates attained by a method of average densities. Big congregations of several dozens to several hundred animals seem to be characteristic for large populations of wild equids with territorial social systems. We have witnessed this not only in Mongolian, but also in Tibetan, Turkmenian and Indian wild asses.

Solitary stallions may be less in evidence or totally absent at certain times of the year, but of course not in the breeding season. The number of solitary animals follows an obviously seasonal trend, as seen in outline in the data of Gobi-A: 35.7% in June/July 2003 (KACZENSKY & WALZER 2003), 16.4 % in August 1974 (BANNIKOV 1975, 1981), and 9 % in September 1994 (DENZAU & DENZAU 1999). According to FEH et al. (2001) solitary stallions were absent in Gobi-B in winter (November). Single animals such as observed by STUBBE et al. (2005) are in our opinion mostly territorial stallions, which may hold (or return to) their territories for years, even if females congregate somewhere else.

DENZAU & DENZAU (1999) described a special mating and defence behaviour in temporary territories near a water hole by male dziggetais in Mongolia. It is hard to draw parallels with the seemingly atypical behaviour of feral asses near a spring as observed by MOEHLMAN (1998) in Death Valley. She found the same male feral ass copulated on his territory as well as outside in non-territorial areas, where multiple males at a high frequency would typically copulate with the oestrous females. This was not the case in Mongolia. Subsequently it appears that the long-term territories of the dziggetais are mainly established for resource defence, while the short-time territories are quickly set up for defence of females in oestrous near the water.

In the past most Russian zoologists took a non-territorial social system of wild asses for granted. BANNIKOV (1981) however doubted some of SOLOMATIN's kulan observations in Badkhyz because they did not fit to a non-territorial organisation. BANNIKOV suspected a methodical observation error, but did not query the supposed harem system.

FEH et al. (1994, 2001) discussed the hypothesis that the Mongolian wild asses in Gobi-B and the Turkmenian wild asses in Badkhyz might have developed a non-territorial social organisation specially because of the hunting pressure of wolf packs (in contrast for instance to Indian and Iranian wild asses, which are nowadays confronted only by solitary hunting wolves of a smaller subspecies). In this connexion we should mention that our own observations of Turkmenian wild asses in Badkhyz, on four visits between 1992 and 2001, fit well with a territorial social organisation (partly in: DENZAU & DENZAU 1999).

Though Tibetan wild asses are threatened by wolf packs as well they show a definite territorial system. Our observations of kiangs (*Equus kiang kiang*) in Ladakh/India (DENZAU & DENZAU 1999) have revealed that kiangs in the mating season (August) live territorially with solitary stallions, unstable groups of mares and foals, and unstable all-male bachelor groups. The size of the territories of 14 stallions could be determined ranging from 0.2 km² to more than 4.9 km² (average above 1.6 km²).

Our observations of different Asian wild ass populations fit without constraint with a territorial system, in contrast to the hypothesis of FEH et al. that the Mongolian wild ass, especially in Gobi-B, and the Turkmenian wild ass show a non-territorial system.

This review indicates that more comprehensive studies are required to understand the peculiarities of the spatial and temporal organisation in Mongolian wild asses, which is according to our investigations a well-defined territorial social system. Reactions to habitat type, seasonal and ecological factors, disturbances by people and predators as well as structure and size of the population, should be taken into account.

Acknowledgement

We would like to thank Colin P. Groves for taking his time to improve our manuscript considerably.

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Address: Dr. Gertrud Neumann-Denzau
 Dr. Helmut Denzau
 Im Brook 8
 D -24321 Panker, Germany e-mail: denzau@t-online.de