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# Feeding Ecology of Asiatic Wild Ass *Equus hemionus*

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# Feeding ecology of Asiatic Wild Ass *Equus hemionus*

J. Lengger, F. Tataruch & Ch. Walzer

## Abstract

The Mongolian Wild Ass or Khulan (*Equus hemionus*) is a potential competitor for forage to reintroduced Przewalski's Horses. To evaluate the major foraging plants of Khulan we chose the alkane method that was first described by Mayes in 1984. Different plant species contain varying amounts and proportions of n-alkanes. This fact allows the determination of diet composition by comparing the plant alkane to the faecal alkane pattern. The major advantage is that the method is non-invasive and has been shown to be a reliable method in captive trials. Faecal and plant samples were collected simultaneously and preserved by drying. The alkane content was determined gas chromatographically after chemical extraction. The diet composition was calculated according to Dove and Moore (1995). The results showed that in autumn 2003 beside some grass like species herbs like *Allium mongolicum* and *Zygophyllum pterocarpum* were the major foraging pants in Gobi B strictly protected area in SW Mongolia.

**Key words:** *Equus hemionus,* nutrition, plant utilization

## Introduction

Since the early 1990´s the Przewalski's horses (*Equus przewalskii*) or Takhis have been reintroduced into the desert-steppe ecosystem of the Gobi B strictly protected area. These captive born animals have to adapt to their new environment as well as to predation, harsh climate, diseases, possible water and food shortage. The Przewalski's horses potentially compete with other wildlife as for example wild ass (*Equus hemionus*) and livestock like the domestic horse for the limited nutritional resources. As part of the Takhi research project we wanted to evaluate the feeding habits of these competitors (WALZER 2003).

## Material and method

The outer surface of plant leaves and stems are covered with a waxy layer that comprises n-alkanes (CHIBNALL et al. 1934). Most plant species have a characteristic pattern of long chain n-alkanes in their cuticular wax that can be recovered from faeces (DOVE & MAYES 1991, O´KEEFE and McMENIMAN 1998). This allows an estimation of diet composition by analysing the n-alkane pattern in faeces and available feeding plants (DOVE & MAYES 1991, DOVE 1992). The n-alkane technique has been successfully used in a variety of herbivore species (HAMELEERS and MAYES 1998, HATT et al. 2001): The method has the potential to discriminate up to 12 different plant species but as the number of components increases the reliability of the method could decline (DOVE & MAYES 1996).

Plant and faecal samples were collected simultaneously. To preserve the alkane pattern all samples were air-dried (simple due to the extremely dry Mongolian climate). For homogenization each specimen is grounded (≤ 1 mm) before chemical extraction. 0.5 mg of faeces and 1.5 mg of herbage was weighed into glass vials, 100γl of internal standard ($C_{34}$ Tetratriacontane) were added.14 ml (plants) and 7 ml (faeces) of 1 M ethanolic potassium hydroxide were added to each vial. The contents were mixed and the closed vials were placed in a hot (90 °C) water bath for 4 hours. After cooling distilled water (4 ml in plants and 2 ml in faeces) and n-heptane (10 ml in plants and 7 ml in faeces) were added to all samples. Samples were mixed well. After

a few minutes the aqueous and solvent layers separated. The solvent layer was transferred by Pasteur pipette to a glass filter column which was previously prepared with 2.5 g silica gel and n-heptane. Once more n-heptane (10 ml in plants and 7 ml in faeces) was added to each sample vial and the procedure was repeated. The filtered eluent was collected in a glass bottle. The collected solvent was evaporated by using a warm water bath.

For gas chromatographically analysis the dried alkane samples were dissolved in 500 γl of n-heptane and immediately transferred to leak proof vials. Finally the solvent was injected into the gas chromatograph.

N-alkanes are determined from their retention times relative to known standards. Carbon chain lengths detected are usually in the range of $C_{25}$ to $C_{35}$. Shorter chain lengths are present in much smaller quantities (DOVE and MAYES 1991). Odd numbered alkanes are present in much greater amounts than even chained alkanes.

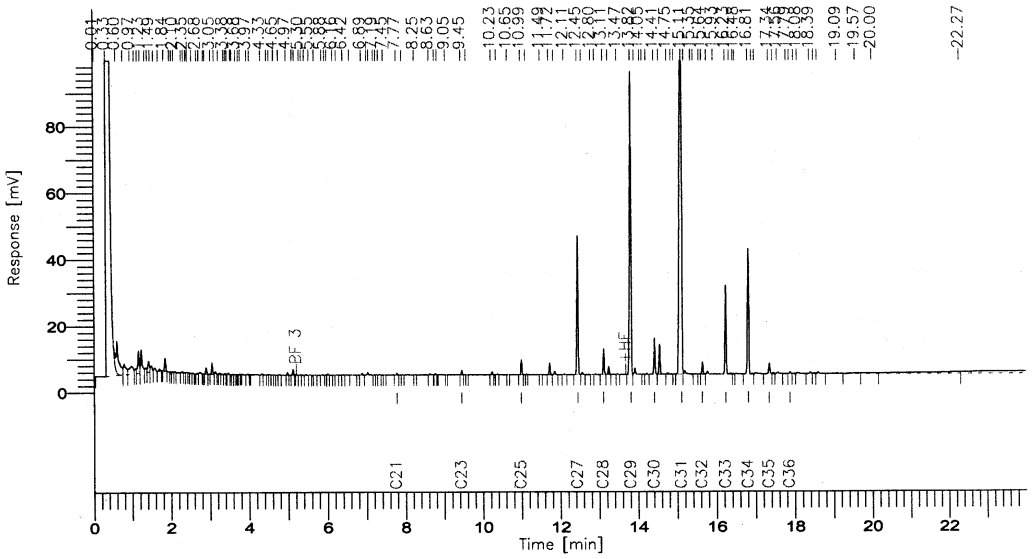


Fig. 1: Gas chromatographic diagram of *Stipa gobica*

Peak areas are converted to amounts of alkane by reference to the internal standard ($C_{34}$) using dedicated software.

To estimate the botanical composition a least-squares optimization was used (DOVE & MOORE 1995). Matrix mathematics enables the computer to combine plant pattern in order to find a composition most similar to the pattern of the faecal sample.

## Results

So far 10 Khulan samples were analysed among other animal species. All samples were tested for the following plants: *Achnaterum splendens, Agropyron desertorum, Allium mongolicum, Anabasis brevifoliata, Carex duriuscula, Ceratocarpus arenarius, Elymus secalinus, Eurotia ceratoides, Reaumuria soongorica, Stipa gobica, Zygophyllum pterocarpum.* These are the assumed foraging plants of the khulan habitat. In this preliminary study results showed that the Khulan in this area predominantly feeds on 4 different plant species: *Allium mongolicum, Zygophyllum pterocarpum, Achnaterum splendens* and *Elymus secalinus.* All other plants could not be detected or were found in much lower quantities.

Table 1: Proportion of plants per Khulan sample in % (10 samples)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Achnaterum splendens* | 22 | 9 | 18 | 11 | 4 | 19 | 23 | 10 | 16 | 19 |
| *Agropyron desertorum* | 0 | 0 | 12 | 0 | 32 | 0 | 0 | 22 | 0 | 0 |
| *Allium mongolicum* | 37 | 40 | 33 | 38 | 6 | 40 | 49 | 14 | 35 | 48 |
| *Anabasis brevifoliata* | 0 | 4 | 0 | 3 | 3 | 0 | 0 | 3 | 0 | 2 |
| *Carex duriuscula* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Ceratocarpus arenarius* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 |
| *Elymus secalinus* | 13 | 16 | 12 | 13 | 0 | 8 | 12 | 0 | 20 | 7 |
| *Eurotia ceratoides* | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 8 | 0 | 0 |
| *Reaumuria soongorica* | 0 | 0 | 0 | 0 | 39 | 0 | 0 | 35 | 0 | 0 |
| *Stipa gobica* | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 |
| *Zygophyllum pterocarpum* | 28 | 31 | 25 | 34 | 4 | 33 | 17 | 2 | 29 | 23 |

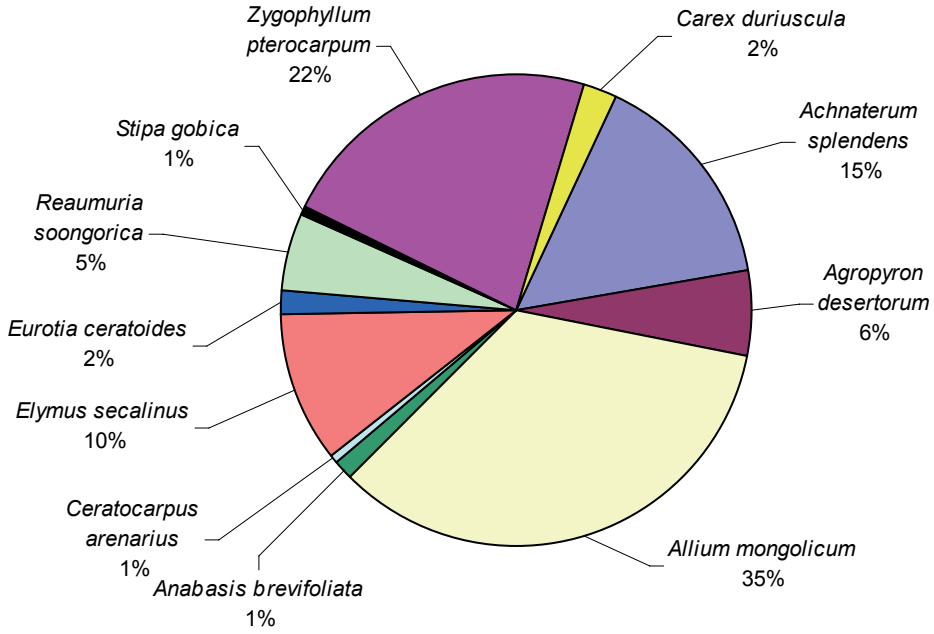


Fig. 2: Circular chart of mean Khulan diet composition.

By far the most frequent foraging plant in autumn 2003 seemed to be *Allium mongolicum* (fig. 3) an onion like plant which is wide spread on the plains of the Gobi B national park. Secondly *Zygophyllum pterocarpum* (fig. 4) could be found. A plant with extraordinary high $C_{31}$ levels and which is named “khulan water” by the indigenous people. As expected Khulan also fed grass like plants such as *Achnaterum splendens*, *Elymus secalinus* and *Agropyron desertorum.*

Fig. 3: *Allium mongolicum*.

Fig. 4: *Zygophyllum pterocarpum*.

## Discussion and outlook

In autumn 2003 Asiatic wild ass on average fed on 5.2 different plant species. This seems to reflect a comparatively low number of different species. Due to the fact that the digestive system of horses stirs the ingesta rather poorly when compared to ruminants, we only gain a small insight with each faecal sample. So the real plant utilization could be more diverse.

All samples contained *Achnaterum splendens*, *Allium mongolicum* and *Zygophyllum pterocarpum*. Amongst these *Allium mongolicum* had the greatest portion (35 %) followed by *Zygophyllum pterocarpum* (22 %) and *Achnaterum splendens* (15 %). *Elymus secalinus* was detected in almost all samples (at an average rate of 13 % in these samples). All other plant species were discovered in minor quantities.

In general the number of detectable plants restricts the alkane method. The more plants the greater the mean error of calculation. This allows the analysis of a maximum of 12 different plant species. This appears to be adequate for habitats with a low number of foraging plants as is true for the arid regions of Mongolia.

Further investigations will concentrate on plant utilization in the course of seasons and in comparison to other equid species.

## References


CHIBNALL, A.Ch.; PIPER, St.H.; POLLARD, A.; WILLIAMS, E.F.; SAHAI; P.M. (1934): The constitution of the primary alcohols, fatty acids and paraffins present in plant and insect waxes. - Biochem. J. **28**: 2189-2208.

DOVE, H.; MAYES, R.W. (1991): The Use of Plant Wax Alkanes as Marker Substances in Studies of the Nutrition of Herbivores: A Review. - Australian J. Agricult. Res. **42**: 913-52.

DOVE, H. (1992): Using the n-Alkanes of Plant Cuticular Wax to Estimate the Species Composition of Herbage Mixtures. - Australian J. Agricult. Res. **43**: 1711-24.

DOVE, H.; MOORE, A.D. (1995): Using a least-square optimization procedure to estimate botanical composition based on the alkanes of plant cuticular wax. - Australian J. Agricul. Res. **46**: 1535-1544.

DOVE, H.; MAYES, R.W. (1996): Plant Wax Components: A New Approach to Estimation Intake a Diet Composition in Herbivores. – J. Nutrition **126**: 13-26.

HAMELEERS, A.; MAYES, R.W. (1998): The use of n-alkanes to estimate herbage intake and diet composition by dairy cows offered a perennial ryegrass/white clover mixture. - Grass and Forage Sience **53**: 164-169.

O´KEEFE, N.M.; McMANIMAN, N.P. (1998): The Recovery of Natural and Dosed n-Alkanes from the Horse. – Anim. Prod. Australia **22**: 337.

WALZER, Ch. (2003): The Utilization of different plant species by reintroduced Przewalski´s horses and other ungulates in the Gobi-B national Park in Mongolia. - Grant-Proposal to the "Jubiläumsfonds" der Österreichische Nationalbank.

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