

**ASSESSMENT OF THE TRADITIONAL PRODUCTION
OF THE HYBRIDS OF INDIAN WILD ASSES
(*EQUUS HEMIONUS KHUR*) AND JENNIES
(*EQUUS ASINUS*) IN KUTCH, GUJARAT***

RIKAKO KIMURA

Research Institute on Human-Equids Relationships, India

MIOKO MASUDA

Graduate School, Mongolian State University of Agriculture

FRENNY SHETH

JAYESH SHETH

FRIGE, Genetics Centre, India

ABSTRACT

The purpose of this study is to assess the traditional and regional system of producing inter-specific hybrids of Indian wild ass and native jennies, by analysis of production method, market value, draughtability, and characteristics and temperament of the animal. Loading and speed tests significantly confirmed that the hybrids have higher draughtability than jennies, but there was no difference between jacks. Temperaments were more nervous than with donkeys. Productions by transhumant communities were subject to vagaries of rainfall and accident during pasturing and migration. The market value was 10 times or more than that of a donkey. Contaminating the wild gene pool with domestic genes is avoided by taking advantage of social structure “territoriality” of wild ass.

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INTRODUCTION

If a wild species or habitat is near pastured or kept near to pasturing or domestic species, exchanges of genes can occur naturally or artificially [1]. For instance, the male Tarpan (*Equus ferus ferus*), a wild type of horse, invaded farms in nearby villages to mate or bring mares (*E. caballus*), so that the numbers of hybrids were increased. The loss of Tarpan distinctiveness accelerated [2]. In a recent instance, back-cross breeding between male wild/feral buffalos (*Bulbalus arnee*) which inhabit wild reserves, and domestic female buffalos (*B. bubalis*), which are kept in neighboring villages was reported [3].

These cases threaten the genetic preservation of wild species, yet on the other hand, from the viewpoint of local communities, they sometimes increase the income to poor people as the result of the cost-free utilization of wild gene resource that confer in advantages of vigor of hybridization or back-cross breeding.

The subjects of this study are the interspecific hybrids of Indian wild asses (*E. hemionus khur*) and native jennies (*E. asinus*) and their production system. In ancient times a fast-running donkey was produced around Kutch in Gujarat [4]. However, only one study has reported on chromosome numbers of a male hybrid from the scientific point of view [5]. We studied the production method, draughtability, external characters, temperament and market value to demonstrate the situation of the hybrid, called “*Adbesra*” (hybrid in the dialect of the Kutch region) or “*Kachaar*” (mule in Hindi). In the study, we shall assess this regional and traditional production system and present some provision for the fringe and peripheral areas of the Indian wild ass sanctuary as a buffer zone.

MATERIAL AND METHODS

The Little Rann of Kutch is located in Kutch prefecture in the northwestern part of Gujarat. The Rann is a seasonal wetland; it becomes a saline desert land in the dry season (October-May), and becomes a wetland, under water 50 cm to 1 m deep, subject to changes of the Arabian Sea tide and flooding of the rivers by rainfall in the rainy season (June-September). Some heights form islands (“*bets*”) without submergence in the Little Rann of Kutch (approximately about 74 islands; min 4.7ha–max 3050ha) [6]. The Little Rann of Kutch has been designated since 1973 as an Indian wild ass sanctuary (the area is around 4,9537 km²). In the surrounding four prefectures, domestic animals are pastured and industrial workers collect salt in peripheral areas. There are some domiciles also in the island. The Indian wild ass is an endangered species with a population of 2839 in the sanctuary [7].

Animal Subjects

For Draughtability Experiments

Five native donkeys in Gujarat state (*E. asinus*) (“donkey” as follows), with estimated weights 95-182 kg, were studied (jack 2, jenny 3). Three Interspecific

F1 hybrids of Indian wild ass (*E. hemionus khur*) and the native donkeys (Figure 1) (“hybrids” as follows), with estimated weights 130-198 kg, were utilized (male 1, female 2). The estimated weights were calculated by withers heights and chest girths [8].

The hybrids were identified as having 59 chromosomes [5] from the results of karyotype analysis by blood samples, which were also identified as adbesra from coat color and external characters.

We treated the experimental data of the hybrids without discrimination of sex, in view of the situation that the male individual was only one, and mules (interspecific hybrid of jack and mare) are used customarily without sex discrimination in India—because there is no difference in working ability between males and females.

For Body Measurement

Six hybrids (male 3, female 3) and 124 donkeys (jack 62, jenny 62) were utilized.

For Assessing Temperament

Ten hybrids (male 5, female 5) and 146 donkeys (jack 73, jenny 73) were utilized.

Human Subjects

For Fact-Finding on the Spot

Twenty-three producers who belong to pastoral communities (the “Bharwads” tribe), 16 dealers, five trainers and fosters/consumers who belong to the basket weaver community, and 41 consumers who are potters or laborers were interviewed.

Experiment and Capturing Data

Measurement and External Characters

Withers height, chest girth, and cannon circumference was measured by simple withers measure equipment and tape measures. We took photographs and made records of coat colors.

Draughtability Experiments

For draught weight experiments, we let the animals pull a wooden cart with two rubber tires on the flat earth course under dry conditions, starting with a 400 kg load (sand sacks) and adding 100 kg each 400 m. If an animal stopped for



Figure 1. Female hybrid (*Equus hemionus khor* × *E. asinus*).

more than 2 minutes, not following the driver's instruction with voice and three times whipping, we stopped the experiment and counted as maximum pulling weight the weight pulled in the last sequence before stopping.

For draught speed experiments, we let the animals pull the same cart on a flat asphalt course with loads as follows: 50–200 kg in 2400 m—in the first 800 m by canter, in the next 800 m by extended canter, and in the last 800 m by continuous gallop. We recorded each furlong and total times and considered the total times as the running time.

We attached a heart rating monitor to each animal during the experiments and recorded their heartbeat just before the experiments and 30 minutes after; and calculated recovery rates. We confirmed also that all animals were under the aerobic exercise regimes in the draught speed experiment in order to check the increase of the heart rates around 200/min. [9].

Experiments were performed at 29–36°C and 20–43% humidity. The animals had been trained for about a year before the experiments.

Assessment of the Temperaments

We used a form with words and scales as indicators for temperament analysis. The words were eight pairs of adjectives as follows: staid-playful, shy-outgoing, calm-nervous, gentle-rough, obliging-willful, friendly-spiteful, content-agitated, handling easy-difficult [10]. We collected the data to check marks on eight scales punctuated into 0 to 10 levels, observing behavior of animals or interviewing from the owners.

Production Methods, Distribution, and Market Value

We got the data on production methods from the people of “Bharwads” tribe and confirmed the production places. For distribution and market-value data, we interviewed dealers, fosters, trainers, and consumers.

Statistical Methods

We adapted a *t*-test for results of the body measurement, draughtability experiments, and principal-component factor analysis for analyzing temperament.

RESULTS

External Characters

Average height, chest girth, and cannon circumference of the hybrids were significantly bigger than for the donkeys ($p < 0.05$ – $p < 0.01$) (see Table 1).

The coat color of the hybrids was bright brown, resembling the Indian wild ass, with a dark brownish, wide dorsal strip clearly extended to the tail and a

cross-stripe that reached from the withers to shoulders. Under the belly, neck, all four legs, and around the muzzle were whites. Zebra strips showed around the knees (see Figure 1).

Draughtability Experiments

The result of draught weight experiments are shown in Table 2. Average pulling weight of the hybrids was significantly heavier than for the jenny ($p < 0.05$), but, on average, the ratio of body weight to pulling weight, was the same for hybrid and jenny. Heartbeat recovery rates also were the same. Comparing with jack, the differences were not significant.

Table 1. Comparison of External Characteristics between hybrids and donkeys

	Withers height*	Chest girth**	Cannon circumference (cm)**
Hybrid $n = 6$ (male 3, female 3)	107 ± 3.7	116 ± 8.2	15.0 ± 1.3
Donkey $n = 124$ (male 62, female 62)	97 ± 5.0	101 ± 6.1	12.4 ± 0.9

Mean ± SD

* $p < 0.05$, ** $p < 0.01$, t -test

Table 2. Comparison of Draughtability between Hybrids and Donkeys in Loading Test with a Cart

	Loading weight (kg)	Rate of body weight (%)*	Recovery rate (%)
Hybrid male, female $n = 3$	933.3 ± 230.9**	600 ± 20	92.3 ± 7.6
Donkey male $n = 3$	833.3 ± 208.2	650 ± 110	87.7 ± 12.4
female $n = 3$	600.0 ± 173.2**	490 ± 150	84.3 ± 10.1

Mean ± SD

*Body weight/load weight

** $p < 0.05$, t -test

The result of draught speed experiment are given in Table 3. Average of total speed of the hybrids was faster than one of the jennies, and recovery rate of heartbeat was higher than one of jacks ($p < 0.05$), but there was no difference in average total speed between the hybrids and jacks, and no differences between the hybrids and jennies in heartbeat recovery rates.

Temperament

Results of analyzing temperaments are displayed in Figure 2. It is extremely definite that the “nervousness” of the hybrid contrasts with the “outgoing” temperament of the donkeys. Female hybrids tended to be more nervous than males. Another clear characteristic of temperaments is that there were more individual varieties of “friendly” to “spiteful” in jennies than in jacks and the hybrids; that is to say, the hybrids and jacks displayed “in the middle” characteristics. There was no sexual distinction in the hybrids on the profile.

Production Situation

We could confirm two methods of hybrid production. One took place in two Kutch villages in which Bharwads live exclusively, adjacent to the western part of the Little Rann of Kutch (see Figure 3). An island “bet” in the Rann is used for pasturing the jenny in the rainy season, which will accidentally lead to the reproduction of hybrids of Indian wild asses and donkeys. The jennies were brought to the island at the start of the rainy season and taken back to the villages when the rainy season finished and water disappeared. There is no further management on the island. The men of the pastoral communities live in the villages in the rainy season, and leave there with one or two pack jenny for

Table 3. Comparison of Draughtability between Hybrids and Donkeys in Speed Test with a Cart

	Total time (min.)	Highest speed(s)*	Recovery rate (%)
Hybrid			
male, female $n = 3$	12:32 ± 1:42**	42:00 ± 4:4	95.7 ± 4.5**
Donkey			
male $n = 3$	13:53 ± 1:38	42:06 ± 7:6	87.7 ± 5.1**
female $n = 3$	15:06 ± 1:09**	51:00 ± 7:0	88.0 ± 9.6

Mean ± SD

*200 m lap-time in 2400 m-run by a canter.

** $p < 0.05$, t -test

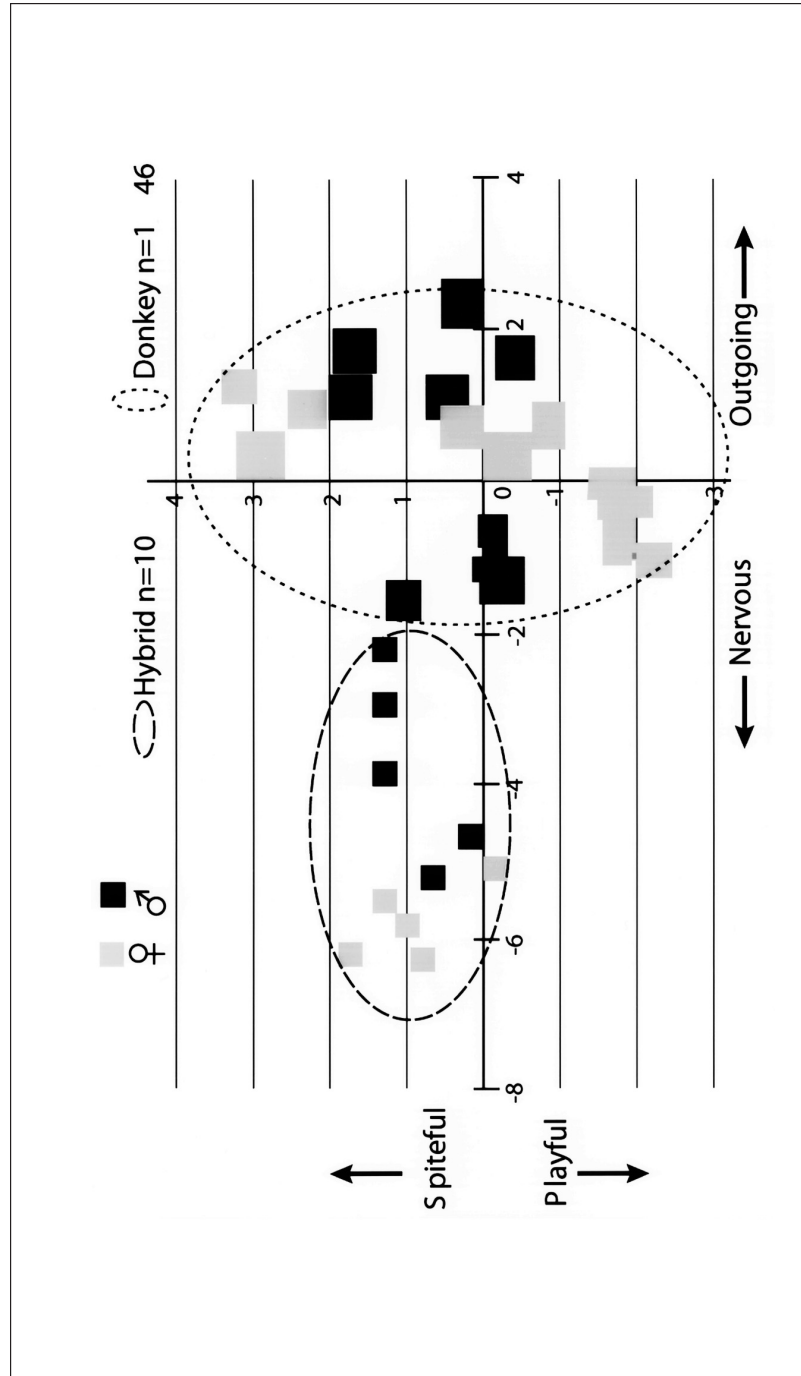


Figure 2. Comparison of temperament between hybrids and donkeys by principal-component factor analysis (PCA).

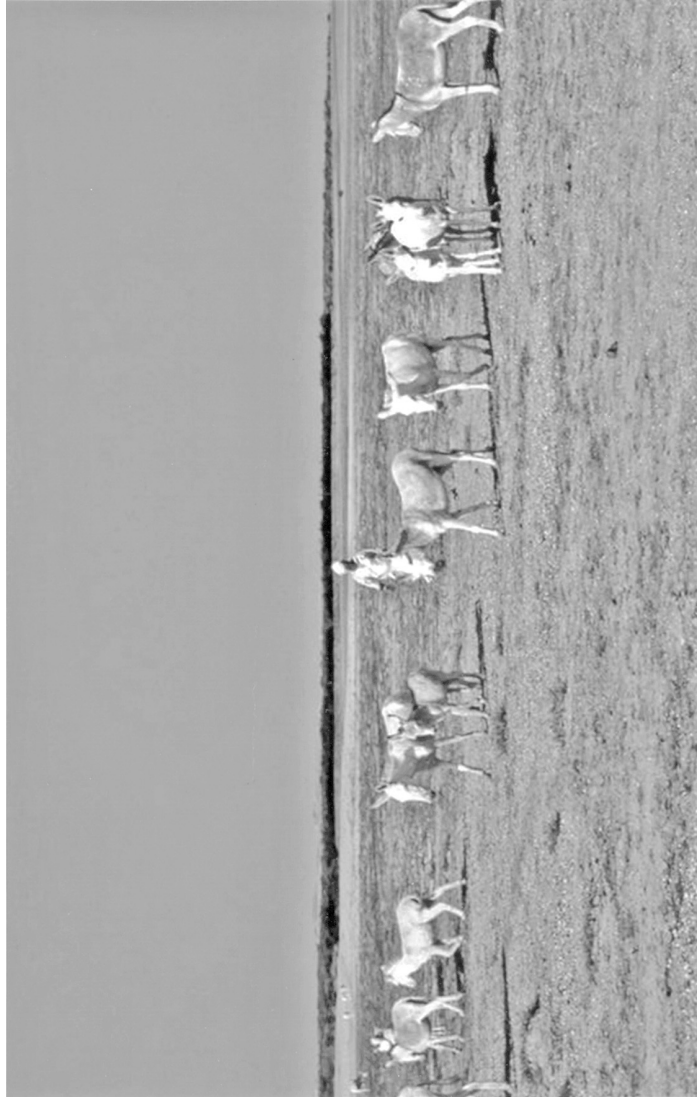


Figure 3. Semi-nomadic tribe “Bharwad” utilize the island for pasturing female donkeys at the Little Rann of Kutch in the rainy season (Kutch district).

pasturing sheep and goats in the dry season, in a semi-nomadic life style. Had there been less rainfall, they would have not performed the “production” and would have prevented the donkeys from scattering and running away, and prevented jennies from competing with Indian wild asses for food plants. According to the interviews with Bharwards, if they had pastured 50 jennies, the total yield was about four hybrid births.

The other method takes place around the fringe/periphery of eastern through southern parts of the Rann (see Figure 4). In practice, male Indian wild asses which have home ranges in fringe areas [6] (up to 10 km from the sanctuary) mate accidentally with jennies of the pastoral communities (Bharwads) who use the periphery area for pasturing and migrating. They migrate in order to pasture their sheep from the villages (a journey of 150–200 km in the rainy season). Women and children of each family, with relatives, bring a tent and household implements on perhaps five packed jennies. The total number of jenny in one herding unit comes to around 30. They do not bring jacks during the migration. The production yield is estimated at not more than five, if about 20 herding units are moved in a rainy season, according to interviews.

Distribution and Market Value

On the trade route, there were several practices. One is to buy and sell the hybrid directly between producers and consumers. A second involves basket weavers and consumers—the basket weavers buy fairly newborn hybrids from the producer and train and use them until age one or one-and-a-half. The third way involves consumers and dealers who bought from producers or basket weavers, and takes place directly or in the fair. The third way was the most measurable, especially in the Vautha fair, the biggest donkey fair in Gujarat, in October/November. We found that two hybrids were dealt in 2003, and confirmed that three hybrids were dealt in 2004.

The cost of the mature animal in the fair was 10 times as much as that of the donkeys (excluding the French breed “Poitou” or interbreeds of Poitou and the donkey). The value differential sometimes increased to 50-fold if the sale was to fanciers. The market demand was low because there are only a few consumers or dealers who have knowledge of the hybrid, especially about its working ability, leading many dealers not to be inclined to deal with hybrids. However, their good looking height, coat color, and the scarcity does add value, so that a small demand has continued from fanciers.

Donkey/hybrid production is a side-job for the pastoral communities, who can get small side-income from producing the hybrids without high production cost because the semen of the wild ass is free. On the other hand, dealing in hybrids can bring extraordinary income for dealers, trainers, or consumers.



Figure 4. Semi-nomadic tribe "Bharwad" are traveling with donkeys for pasturing sheep at the fringe area of the Little Rann of Kutch in the rainy season (Surendranagar district).

DISCUSSION

We could not confirm when the production of the hybrid had started through our research work, but it is said that it dates to ancient periods. In a similar example, Sumerians produced the hybrid of wild ass (*Equus hemionus onager/E.h.hemippus*) and domestic donkey for pulling chariots in Mesopotamia in 3000 BC, as a stage in introducing the horse [11]. It is not certain whether the specific breeding aim for producing bigger and faster draft animals existed in the Kutch region since ancient days, but we can conceive that such a hybridizing method has continued with an advantage of hybrid vigor in experienced communities. It is considered that the production system is an indigenous and sustainable breeding method, which does not suffer from typical problems such as high cost of semen or heritability of detrimental factors. These problems often have occurred in cross-breeding with exotic breeds to produce bigger domestic animals during the modern age.

As to contemporary hybrid production, we must make utmost care to avoid threatening conservation of endangered species. If we assess the system from the viewpoint of symbiosis of wild asses and the semi-nomadic communities as the producer in the buffer zone, we can find the natural precaution which are brought by social constitution of “territorial society” [7, 12] of Indian wild ass to be the same as for others species of wild ass and Grevy’s zebra. In other words, the social constitution prevents the wild gene pool from contamination by domestic genes. Equids of territorial society have territories by one male and mate female animals visiting the male’s territories in breeding seasons. Equids having a harem society, for example, feral horses, mountain zebra, and savanna zebra, make a harem by a male with few or several females which last for a few months to a few years; the bonds between members are stronger than in territorial society.

In fact, jennies pastured on the island in rainy season do not make intimate relationships between females of Indian wild asses. Even if they would mate with the asses, the jennies come back to their owners, responding to the owner’s calling, and the possibility of gene contamination between two species is extremely low. On the other production system, around border areas which in jennies travel and are pastured with semi-nomadic communities in rainy season encounter with male wild asses, the contamination is prevented by the territorial society. Males of Indian wild ass which try to approach the jennies are thought to be bachelors or solitary males which do not have their own territories in the rainy season. Most of the jennies have already finished breeding at their resident place in the dry season, so that we think the production system does not bring semen of the wild ass directly and infrequently provokes the male wild ass.

As we have described, the conditions that prevent contamination of genes work wisely as a system. Yet the population of Indian wild ass has decreased sharply from spreading African horse sickness transmitted by bloodsuckers since 1961 [6]. Therefore it is very effective, indeed essential, to encouraging vaccination of

domestic Equids of semi-nomadic people and village people around the Little Rann of Kutch. Furthermore, the increase in encounters between the wild ass and spreading agricultural activity will subject the sanctuary to increasing pressures. The importance of monitoring these wild animals will grow, including monitoring for any hybrids that might run away from owners and intrude into the sanctuary.

The hybrids showed draughtability that reinforces the weak points of each sex of the donkeys; the hybrids can pull heavier loads than female donkey, and have better heart recovery rates than male donkeys. The average weight of draught and speed of the hybrids were slightly but not significantly higher than for male donkeys. It is suggested that these results are brought about by hybrid vigor as to enlarging height, circumference, and canon, and developing heart and lung function. According to the Ebra document, the hybrid of Asia wild ass (presumption) and domestic donkey, was produced for pulling chariots or carts because of their largeness and toughness, in the ancient city of Nagar in northwestern Syria (present-day “Tel Bruk”) around 2300 BC. The trade price was 40 times more than that of the donkey [11, 13, 14]. We can recognize that the hybrids also show similar characteristics.

The average heart recovery rate in the draughtability speed experiment was higher in female donkeys than in male donkeys, perhaps because hemoglobin volume in female donkeys is higher than in male donkeys [15].

The temperament analysis of the hybrid’ nervousness demonstrated the story handed down by mouth that it is very difficult to handle and train them. However, according to some interviews, if hybrids grow up tamely with humans from birth, they become easy to train for working afterwards. The hybrids are considered sterile, but we should also guard against the low possibility of the birth of a fertile one, perhaps from accidental gene contamination, by encouraging owners to keep the hybrids fenced in, if they are not able to be tamed.

The typical distribution of the hybrid is as follows: seasonal-nomadic people produce the animals with low impact methods for the wildlife resource (ass) and natural resource (grass), then they sell it to consumers (a potter community directly, or the trainer/foster, as with a basket weaver community). The basket weavers use immature donkeys or the hybrid for light pack work mainly in dry season, and trade with donkey-dealers when the animal has highest value around maturity. The dealer does trade them in a donkey fair for higher prices than donkeys. The expenditure on the hybrids from production to training is low in cost, and the animals are used and sold in the same way as donkeys—non-wastefully, with increased trade value. The production, utilization, and trade routes of the hybrids is fairly stable for each community (“*Jaat*”) nearly, which is a main reason for the continuity of the production system.

Furthermore, the main pathway to avoiding exhaustion of wildlife resource is the sustainable, symbiotic connection of transhumant societies to their environmental surrounds [16-18]. These societies limit themselves to producing the hybrids as a side job, and receive them as if they are accidental gifts.

The communities' techniques for adapting to semi-arid ecosystems [19] and their attitude (in other words "contemplation") to their background bring sustainability to the production system.

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Direct reprint requests to:

Rikako Kimura
 1037, Pocket A – Sector A
 Vasant Kunj, New Delhi 110070
 e-mail: rikakokimura@hotmail.com