

Horse Genetic Resources of India

Spiti Ponies



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A View of Pin Valley

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Preface

Horse has played a special role in development and shaping of human civilization. The rise and fall of empires, conquest of whole continents, great battles, development of transport system, mail, agricultural progress and sport were carried out on horse's back. In spite of the setback to its importance on account of development of roads and machinery, horses are still reared in the high altitude areas considering their suitability for transportation in such tough terrains. The Spiti ponies, which are reared in the cold desert area of Himachal Pradesh, play an important role in the economy of that area by performing very important tasks like immediate transportation of highly perishable cash crops and fruits, bringing forestry produce such as wood, logs and other minor produce to the road heads / depots, transporting building material like sand etc. from rivulets / riverbeds to the construction sites, maintaining supply of food grains through public distribution system particularly to tribal communities in far flung areas and even thrashing of cereal crops. An attempt has been made to compile available information on physical characteristics, management practices, geographical distribution, production traits, reproduction parameters, important ailments, blood profiling and genetic variability of Spiti horses. This document will be useful to researchers and planners alike in planning conservation strategies and undertaking breed improvement programmes for these magnificent ponies of our country.

The authors take this opportunity to thank all the researchers who initially generated information on various aspects of Spiti breed of ponies.

Authors

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History and Importance of Breed

The horse was domesticated about 6000 years ago somewhere in the Steppes area of present day Southern Russia and Ukraine. Since then the horses have played an essential role in the development of human civilization for their indispensable use mainly in transportation and other activities like agriculture or sports. They still remain an excellent mean of transportation in high altitude mountainous areas the world around including India. India is home to six distinct breeds of horses namely Kathiawari, Marwari, Zanskari, Bhutia, Manipuri and Spiti. The Kathiawari and Marwari horses are the natives of desert region of Western India. The Himalayas and North-eastern hill areas of our country are home to other four breeds all of which are small sized and classified as ponies. The Zanskari ponies are found in the Zanskar region of the Jammu and Kashmir province, whereas, Bhutia ponies are distributed all along the Tibet border in middle as well as Eastern part of the Himalayas. The Manipuri ponies are found in the hilly areas and valleys of Manipur state in Eastern India (Bhat *et al.*, 1981).



Spiti pony in traditional gear and a local bridle

The Spiti horses are tireless gaited ponies famous for its adaptation to high mountainous cold desert region of Western Himalayas. It is thought that they originally came from Tibet as Tibetans have very similar type of ponies. The people of Spiti area have traded with Tibet for centuries and horses were obviously main form of transportation as well as highly priced possessions. Locally they are also referred as *Chmurthy* horses. The Spiti horses are very strong, sure footed and well known as excellent riding ponies. The Spiti horses are also used as pack animals as well for transportation in the high altitude areas. They have the ability to smell glaciers. They can easily move on sloping and snowbound areas. They can survive well in scarcity of feed and fodder during snow bound harsh months of the winters. They have incredible stamina and are able to take long journeys at high altitude area of 3500 to 5000 meters which has thin atmosphere with comparatively lesser oxygen available for breathing. Usually they are very calm, easy to handle and very willing to go. They are very rarely bad tempered. It is not unusual to see people riding double on these sure footed ponies, moving at a pace or running walk along the paths linking the various villages.



Spiti ponies at an auction in a village

They are the only means of transport in these difficult mountain terrains and hence perform unique role in carrying out multifarious activities such as immediate transportation of highly perishable cash crops and fruits, bringing forestry produce such as wood, logs and other minor produce to the road heads / depots, transporting building material like sand etc. from rivulets / riverbeds to the construction sites, maintaining supply of food grains through public distribution system, particularly to tribal communities in far flung areas and even thrashing of cereal crops. Hence, they are indirectly associated with the economy of the farmers. They are also used for playing polo at high altitude areas. Besides, breeding of Spiti ponies has been adopted as the major source of livelihood in the Pin valley of Lahaul-Spiti district of Himachal Pradesh.

Geographical Distribution of the Breed

The main breeding tract of these animals is confined to the Pin valley of the Spiti area Himachal Pradesh. The climate and the rich grasses of the valley produce extremely sure footed horses able to negotiate great heights without much difficulty. A tourist in the Pin valley may see scores of horses, colts and fillies grazing on the river banks and some youths galloping away on these horses singing wildly in joyous abandon. The horse rearing, breeding and trading is an age old tradition in the pin valley area and provides a good source of income to the local people. The horses bred in the area are sold at considerable prices at Ladarcha fair at Kaza, Changthang area of Ladakh and Lavi fair at Rampur Bushair in Shimla district every year. The horse buyers from other places also visit the valley in summer season to purchase them from as far as the Kingdom of Bhutan. Although the main breeding tract is in the Pin valley but the sizable population is also spread over the adjoining area of Lahaul and Spiti district, Yanthang area of Kinnaur district, Pangti subdivision of Chamba district, Bara Banghal area of Kangra district and some parts of Mandi district of Himachal Pradesh (Singh *et al.*, 2005).



The area of distribution (top) and breeding tract (bottom) of the Spiti horses

Population and Breeding Farm

The population of Spiti horses has been estimated to be about 4000 ponies (Singh *et al.*, 2005). The Himachal Pradesh Government Horse Breeding Farm located at Kamand in district Mandi of Himachal Pradesh maintains Spiti horses. Realising the importance of the Spiti horses, the Himachal Pradesh Government is trying to sustain it and has launched a breeding programme for Spiti horses.

Morphological Characteristics

The Spiti horses are of smaller size having an average height of less than twelve hands with plain looks. They have a fine head, almost like a

Body measurements of the Spiti horses as observed in the breeding tract (Katoch et al., 2004 a)

S.No.	Parameters	Body measurements	
		Males	Females
Below one year			
1.	Ear length (cm)	10.05 ± 0.30	11.07 ± 0.33
2.	Tail length (cm)	29.34 ± 1.70	35.11 ± 4.15
3.	Chest girth (cm)	98.76 ± 2.73	99.46 ± 3.27
4.	Height at withers (cm)	95.40 ± 2.36	94.49 ± 2.74
5.	Body length (cm)	96.56 ± 2.41	95.50 ± 2.78
6.	Body weight (kg)	85.32 ± 3.32	80.26 ± 5.58
7.	Circumference of cannon (cm)	4.52 ± 0.09	4.79 ± 0.11
1-3 Years			
8.	Ear length (cm)	12.87 ± 0.36	12.94 ± 0.46
9.	Tail length (cm)	49.83 ± 2.35	50.20 ± 3.13
10.	Chest girth (cm)	138.64 ± 1.43	135.41 ± 1.36
11.	Height at withers (cm)	124.87 ± 1.26	123.42 ± 1.03
12.	Body length (cm)	117.76 ± 1.61	113.91 ± 1.13
13.	Body weight (kg)	185.00 ± 5.32	180.59 ± 4.75
14.	Circumference of cannon (cm)	5.86 ± 0.09	6.23 ± 0.11
Above 3 Years			
15.	Ear length (cm)	15.33 ± 0.34	15.56 ± 0.17
16.	Tail length (cm)	70.26 ± 1.89	55.55 ± 1.29
17.	Chest girth (cm)	143.12 ± 0.60	140.56 ± 0.61
18.	Height at withers (cm)	132.14 ± 0.64	131.19 ± 0.67
19.	Body length (cm)	129.85 ± 0.85	122.28 ± 0.94
20.	Body weight (kg)	239.84 ± 3.20	223.77 ± 2.45
21.	Circumference of cannon (cm)	7.23 ± 0.06	7.60 ± 0.05

Welsh pony, and their abdomen is barrel shaped. They have well built, thick set muscular bodies with fairly strong bones. They have strong legs, hard feet with round strong hoofs which are seldom shod (Pundir *et al.*, 2004).



A stallion of Spiti breed



A mare of Spiti breed

They have a short, strong back and neck, good hind quarters, and tend to be wider in the chest than most other ponies found in this part of the Himalayas. The pre dominant body colour is grey followed by black, black flay bones (white body with black patches), brown or bay. The observations of a total of 1195 Spiti horses for various morphometric parameters taken at various locations in breeding tract revealed that the adult male and the female Spiti horses are 132.14 ± 0.64 and 131.19 ± 0.67 cm in height, 129.85 ± 0.85 and 122.28 ± 0.94 cm in body length, 143.12 ± 0.60 and 140.56 ± 0.61 cm in chest girth, 239.84 ± 3.20 and 223.77 ± 2.45 kg in body weight and the tail length is 143.12 ± 0.60 and 140.56 ± 0.61



The head of Spiti horse in close-up

respectively. The ear length in male and female animals is 15.33 ± 0.34 and 15.56 ± 0.17 cm, respectively. The circumference of cannon is 7.23 ± 0.06 and 7.60 ± 0.05 cm, respectively in male and female horses. It has been observed that males have more height at withers, body length, body weight and chest girth than their female counterparts at reproductive ages. The

variation may be attributed to the physiological differences among the two sexes. The linear growth was observed during the age of one to three years as reflected by increase in height at withers, body length, body weight and chest girth in tune of 27.8, 25.6, 64.6 and 30.9 percent, respectively, for male horses. The corresponding figures for female horses were 27.3, 21.9, 61.9 and 29.2 percent, respectively. The pattern of growth was identical for both the sexes (Katoch *et al.*, 2004a).



A foal of Spiti breed

Reproductive Traits

The females attain puberty much earlier than male animals. The average age at first covering in females and males has been observed to be 18.63 ± 0.09 and 32.24 ± 0.76 months, respectively. The average age at first foaling is 43.68 ± 0.13 months. Though the natural service was practiced for covering, yet mares required more than one services before successful conception. The average service period, foaling interval and gestation period were observed to be 29.35 ± 1.58 , 371.73 ± 1.69 and 332.26 ± 0.63 days, respectively. The breeding is so regulated by the local breeders that most of the foalings occur at the onset of summers during April / May months and

subsequent estrus. In Spiti mares, 6 to 10 lifetime foalings are observed with a mean of 7.98 ± 1.88 . The broodmares with higher reproductive efficiency and good pedigree performance were reared by the owner for the longer period whereas other stocks were usually sold off.

**Reproductive traits in Spiti horses based on observations on
529 Spiti horses (Katoch et al., 2005)**

Trait	Mean	Range
Age at first estrus (months)	18.63 ± 0.69	15 - 24
Estrus cycle duration (days)	20.12 ± 0.32	19 - 23
Estrus duration (hours)	8.10 ± 0.05	6 - 10
Age at first fertile service (months)	32.24 ± 0.76	30 - 34
Age at first foaling (months)	43.68 ± 0.13	41 - 46
Number of services per conception	2.17 ± 0.03	2 - 3
Service period (days)	29.25 ± 1.58	10 - 50
Gestation period (days)	332.26 ± 0.63	320 - 345
Foaling interval (days)	371.73 ± 1.69	345 - 380
Number of lifetime foalings	7.98 ± 1.88	6 - 10
Age at first covering in males (months)	30.14 ± 0.18	28 - 32

Hematological Profile

Since, the Spiti horses thrive in high altitude area, the adaptational changes in their hematological profile can be expected. The average hemoglobin in Spiti horses in high altitude area varies from 10.60 to 17.80 gm/dl with an average of 14.0 ± 0.49 gm/dl. The hematocrit concentration in Spiti horses is 33.8 ± 0.89 percent. The mean erythrocyte count, total leukocyte count, mean corpuscular volume and mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration in these ponies are 8.61 ± 0.63 million/ μ l, 11.90 ± 1.17 thousand/ μ l, 41.0 ± 3.27 Cu. μ , 15.98 ± 1.09 μ / μ l and 35.29 ± 0.93 percent, respectively (Kumar et al., 2004).

Mineral and Biochemical Profile

The analysis of blood samples from 38 adult Spiti horses revealed average levels of Calcium, Phosphorus, Sodium, Potassium and Chloride to be 12.49 ± 0.55 mg/dl, 5.22 ± 0.36 mg/dl, 143.27 ± 2.12 mEq/l, 4.47 ± 0.23 mEq/l and 77.80 ± 3.41 mEq/l, respectively. The biochemical analysis of these samples revealed the levels of total proteins, albumin, bun, creatnine, total bilirubin, SGOT and SGPT as 8.45 ± 0.60 g/dl, 2.82 ± 0.09 g/dl, 20.72 ± 0.46 mg/dl, 0.71 ± 0.02 mg/dl, 0.48 ± 0.05 mg/dl, 1.05 ± 0.08 mg/dl, 197.70 ± 11.48 U/l and 23.89 ± 2.31 U/l, respectively. The little lower levels of chloride, albumin and creatnine and little higher total protein and direct bilirubin may be attributed to the different environmental conditions in which these horses are reared (Katoch *et al.*, 2004b).

Management Practices in the Field

The Spiti horses having originated from an area with little vegetation are easy keepers. The herd size ranges from 1 to 3 animals. Majority of the equine rearing families of Himachal Pradesh (83.05%) practice both stall feeding and grazing. In winter months of December to April, when only stall feeding is possible, farmers provide their animals with stored fodder and small amount of concentrates comprising mainly of barley and *Pisum sativum*. The majority of the farmers provide fodder and water twice a day. Owing to the very little availability of cultivated fodder in breeding tract of Spiti horses, the chaffed green fodder is not provided. The rock salt lick is regularly provided to the animals. They use Spiti horses as pack animals to carry their luggage especially when they move to higher meadows for grazing the livestock. The alpine grasses are considered of very high nutrient quality for the Spiti ponies (Dogra and Chauhan, 2004; Pundir *et al.*, 2005).

The horses are housed in stone walled enclosures besides the houses of the farmers. In the winters the farmers in these areas share their houses with their livestock species including Spiti ponies keeping them in the ground



Spiti horses in grazing in a village pasture

floor whereas upper stories of the house are occupied by the human inhabitants of the family. Animals are reared on grazing in highland pastures during summer months from May to November. Most of the farmers groom their animals regularly.

Breeding Practices

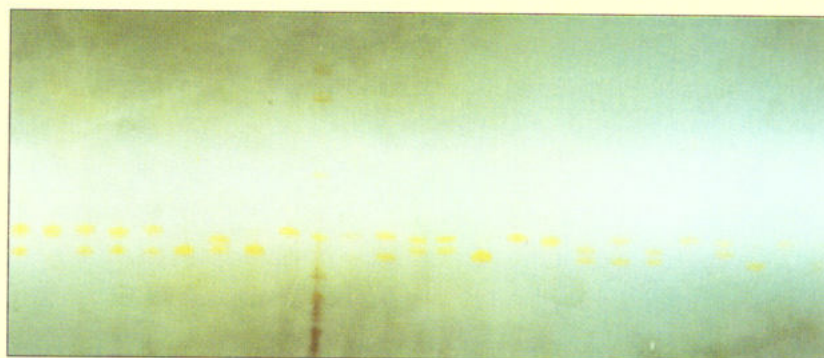
The Spiti horse breeders are well aware of modern scientific breeding programmes which they are incorporating in their traditional breeding strategies since ages. The selection of the stallions is done by a committee of elderly and experienced people of the village. All the eligible stallions of the area are paraded before them on a particular day, where thorough selection for body confirmation, colour, markings and gait is done. Later all other breedable males, except the selected ones, are got castrated with the help of animal husbandry experts. The selected stallion is used for breeding purposes and is replaced every alternate year. The people have to pay for covering their broodmares in cash or kind as prescribed by the committee. The Breeding season is from February to July. The natural breeding methods are practiced (Dogra and Chauhan, 2004).

Important Ailments

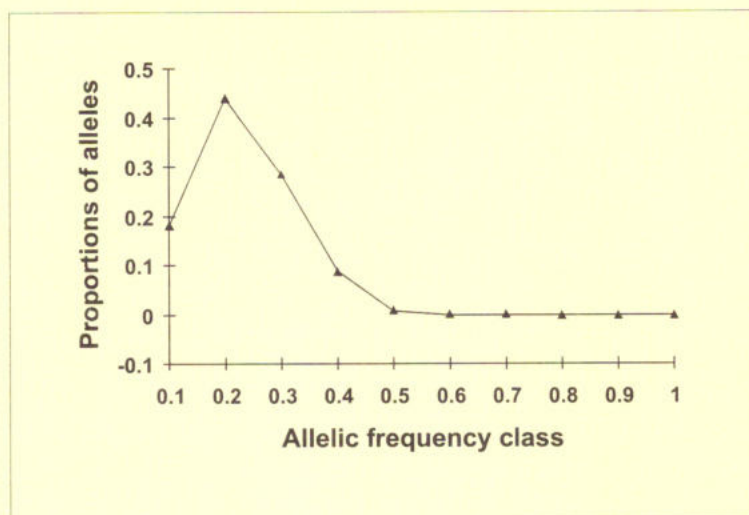
In Spiti horses, Colic ailments are predominant followed by the diseases of respiratory tract other than asthma. Ailments related to urinary tract especially blockage of urination was also reported in many cases. In the event of any ailment initially self medication is provided due to the far flung location of the veterinary institutions and then the animal is taken to the these veterinary hospitals to avail the services of qualified veterinarian. The people follow some interesting traditional prescriptions for treating some of these ailments with variable succes (Dogra and Chauhan, 2004). The helminth worms of gastro-intestinal tract like *Strongylus vulgaris*, *Tridontophorus serratus*, *Oxyuris equi*, *Parascaris equorum* and *Anoplocephala sp.* are also quite common (Katoch *et al.*, 2003).

Genotyping of Spiti Horses

The genetic characterization of Spiti ponies for population structure and diversity using a set of twenty five microsatellite markers was carried out at National Bureau of Animal Genetic Resources, Karnal. The polymorphism information content of these loci ranged between 0.66 at locus NVHEQ79 to 0.85 at loci AHT4 and HMS7, which reflected the suitability of these markers for such genetic characterization studies of



PCR products at locus HTG4 after resolution on urea polyacrylamide gel and visualized by silver staining in Spiti horses



Graphic representation of proportion of alleles and their distribution in Spiti horses at twenty five microsatellite loci.

Indian horses. The results of this study revealed that the total number of alleles at the studied loci ranged between two (NVHEQ 79) to seven (AHT4 and NVHEQ 18). The polymerase chain reaction product size range varied from 84-100 bp at locus HTG6 to 242-250 at locus UCDEQ425. The mean observed and expected heterozygosities were 0.56 ± 0.09 and 0.78 ± 0.08 , respectively. These values were also reflected in mean effective number of alleles of 4.61 ± 1.1 . These results indicate decrease in diversity of Spiti horses. Keeping these observations in view and considering the fact that the total population of the Spiti horses has declined drastically over the years due to spread of road network; it was felt necessary to analyze these data to know whether recent genetic bottlenecks have occurred in Spiti horse population.

Since, the population bottlenecks induce a transient excess of heterozygosities, observed / expected heterozygosity across all loci in a population will reflect recent bottleneck in a population. The computations were made using Bottleneck computer package. The expected numbers of

loci with heterozygosity excess were 14.63, 14.82 and 14.85 for IAM, TPM and SMM, respectively. All the 25 loci were observed with the heterozygosity excess in three mutation models (Behl *et al.*, 2005). These values are significant using Sign Rank test suggesting that Spiti horses have undergone recent genetic bottleneck. These observations were confirmed by standardized differences test which showed the static T_2 values of 7.807, 7.115 and 6.127 for Spiti horses in IAM, TPM and SMM models, respectively. Similar results were obtained in Wilcoxon Rank test, which gave almost zero probability values in all three mutation models in Spiti horses. In the quantitative method of estimation of bottlenecks the Spiti horses also showed a clear mode shift supporting the conclusion based on the other tests that the Spiti horses have undergone recent genetic bottleneck and necessary steps to ensure the required genetic variability in the population are recommended.

Conservation

Since, the population of Spiti horse as also of horses in general has decreased considerably in the recent past due to improvement in road network. The total present population of Spiti horses is supposed to be stabilized at about 4000. The farmers of Pin valley area have adopted horse breeding as their main profession as Spiti ponies are in still in demand in other high altitude area as well as from army for transporting materials to forward posts which is sustaining these animals. However, ever increasing road network is posing threat to these magnificent animals. Moreover, it has been observed that the literate younger generation of this area is averse to adopting horse rearing as profession. In view of these facts and observations that the Spiti horses have undergone recent genetic bottlenecks, a conservation programme was undertaken by National Bureau of Animal Genetic Resources under Network Project on Animal Genetic Resources in collaboration with Himachal Pradesh Krishi Vishaw Vidyalaya, Palampur. A total of 58 elite female animals were selected under Kungari and Sagnum panchayats of Pin Valley based on score card given in the report. A total of

23 male and 12 female progeny were born. Out of the total progeny born, six were selected and registered. The owners were given the financial aid for rearing these animals.

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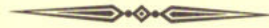
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