Review article

HISTORY OF RINDERPEST CONTROL AND ERADICATION IN MONGOLIA

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1. RINDERPEST OUTBREAKS AND CONTROL CHALLENGES BEFORE THE ESTABLISHMENT OF VETERINARY SERVICES IN MONGOLIA

According to Mongolian historical records, although many of them are circumstantial and incomplete, rinderpest has been recognized in Mongolia for many of hundred years as a terrible cattle disease, called "*myalzan*" in Mongolian, with the threat of huge losses in the cattle population.

Dr. D. Maidar (1962), in "*Mongolian Contemporary Veterinary Services (1921–1956)*", quotes on page 92, "*….. as mentioned in a report of 1763, issued by Tusheet Khan province (*now the central part of Mongolia*), 217 cattle were dead with rinderpest…".*

Mr. Tserenlkhundev, a Governor of one *khoshuu* (the local administrative unit in Mongolia till 1924) in Tsetsen-Khan province (aimag - reported to the Provincial Governor in 1883 that rinderpest was widely occurring in his area of governance. Likewise, an 1869 report of one khoshuu of Khalkha stressed that "*… besides progressive emaciation and losses of livestock due to immense cold, rinderpest has arisen causing huge mortality that results in extensive poverty among rural habitants….. and ….. they are looking for support…..*"

These reports indicate that rinderpest was a real threat to both Mongolian livestock and the economy because of the country's inability in effectively combating the disease.It is recorded that the first science-based attempts to fight rinderpest were taken at the beginning of the 20th century by Russian livestock merchants who gave rinderpest-protective injections to Mongolian cattle to be exported to Russia. G. Dashnym G. (1998) referred to the conclusion from previous studies conducted by Russian veterinarians (Grytsenuk and Doroshaev, 1950) that rinderpest had spread across two-thirds of Mongolia with annual losses of approximately 120,000 cattle and yaks per year in the 1910-1920s. Based on other historical records on disease occurrence, it is considered that rinderpest was first diagnosed scientifically in Mongolia in 1910 by Russian veterinarians.

The first unit for production of anti-rinderpest hyperimmune serum using technology developed by Professor N. B. Nents was established in 1904 by Russian veterinarians, headed by Dr. A. Dudukalov, in the Eruu river basin near the Russian border (*Dudukalov, 1904.*). This enabled immunization of cattle for export to Russia and also cattle at risk of infection elsewhere.

After 1910, when the Bogd Khaanate of Mongolia was established (the period of Theocratic Mongolia) as result of victory of the National Independency Movement in Mongolia, Russian merchants expanded their trade by simultaneous support of the Russian Government with a rinderpest epidemiological survey and widening of the passive immunization of cattle for increased exports of Mongolian cattle to Russia.

Russian veterinary field expeditions (four immunization teams of veterinarians, veterinary technicians and interpreters in 1910–1911, seven in 1912 and twelve in 1913) organized from the Chita Rinderpest Control Division, carried out simple epidemiological surveys for rinderpest and immunized 456.6 thousand cattle (Table 1) in

Khentii, Dornod, Khusvgul and Ulaanbaatar, as well as Shiliin Gol province of Inner Mongolia, China (Khukhuu A, Tserendorj Sh, 2003).

Table 1

Number of cattle immunized against rinderpest

Year	Number of immunized cattle
1910-1911	42,875
1912	74,085
1913	121,117
1914	65,004
1915	53,499
Total	356,580

Besides immunization of cattle brought by Russian merchants, the Russian veterinarians offered Mongolian herders a paid service to immunize their cattle with charges of 1.5 yanchaan *(Mongolian silver tugrug)* per cattle head. Yak and khainag *(a hybrid between Mongolian cattle and yak)* cost 4 yanchaan per head because of their high susceptibility to the infection. In 1913, Russian veterinarians immunized 13,116 cattle in Khuvsgul province, 41 % of which were owned by Mongolian herders (Maidar, 1962b). Although the anti-rinderpest immunization of cattle to be exported to Russia was primarily focused on preventing a possible spread of rinderpest into Russia, the Mongolian Bogd Khan Jebtsundamba rewarded Dr. Dudukalov and his colleagues with '*otog jins'*. This indicates owner's status or title and indicates high appreciation for their achievement and contribution to reduce the spread of rinderpest in various provinces of Mongolia (Dashnym G. 1998). Furthermore, the Bogd Khan considered it essential to establish a local production unit for rinderpest hyper-immune sera and permitted this to be built in the Songino area of Urguu (now Ulaanbaatar) in 1920.

2. RINDERPEST OUTBREAKS AND THE STRUCTURED CONTROL EFFORTS OF VETERINARY SERVICES

Rinderpest outbreaks in 1923-1949

The Mongolian Government established its first Veterinary Service Unit in 1923 at the Ministry of Finance. Combating rinderpest was its primary task as this was one of the priority actions for the Mongolian Government in the beginning of the 1920's. The privately owned anti-rinderpest serum production unit at Songino was purchased by the Government in August, 1923, and its operation placed under the Veterinary Service Unit. Due to a shortage of national veterinarians, a Russian veterinarian, Dr. Dudukalov, an earlier owner of the unit at Songino, was appointed as Head of the first veterinary services of Mongolia. During his management of the Mongolian Veterinary Services until 1928, he expanded the production of hyperimune serum, together with Russian colleagues – 6,003 litres in 1924, 6,597 litres in 1925 and 12,681 litres in 1926, (*Ch. Zorigt, 2001*).

Historical sources note that structured and planned control efforts against rinderpest in Mongolia started formally in 1923 and control measures to combat and eradicate the disease were implemented according to Government plans.

Between 1924-1927, rinderpest was widely spread in the eastern part of the country as a result of incursions from China. The source of rinderpest introduction was considered to be the free movement of wildlife across the Chinese border, namely the Mongolian gazelle (*Procapra gutturosa*) and known to Mongolians as *dzeren*. It was also reported that draught cattle used as the main source of transportation between the Mongolian capital - Ulaanbaatar - and the Chinese cities of Khaalgan, Guihuachin, Manijchuria and Hailaar played a significant role in introducing the disease. In 1924, for example, more than 110 thousand bullocks and camels were used for hauling goods from China - automobile and rail transportation system were not then developed.

In 1926, the disease had spread to the west, resulting in new outbreaks at Zaya Monastery, Uizenvan, Tariat (Arkhangai) and Uliastai (Zavkhan). In total, 117 cattle herds were officially recorded as affected with rinderpest in 1926.

In such a difficult epidemiological situation, the newly established Mongolian Veterinary Service developed activity to control rinderpest with:

- establishment of 16 task units along the main bullock-train routes crossing the eastern and south-eastern parts of the country for obligatory registration and identification (ear-marking and horn or hoof branding) of cattle with clinical signs suggestive of rinderpest and immunization of cattle showing no clinical signs.
- set-up quarantine in outbreak situations in more populated provincial centers to prevent infected animals or those not yet showing signs from spreading the infection furthe
- use only immunized bullocks in houling the goods between Ulaanbaatar, Altanbulag, Lamyn Gegeen, Sain-Khan, Uizen Van, Zag, Tariat and Uliastai, which were main populated centers of rinderpest risky areas in 1930's, and quard bullock-train to prevent possible changes of bulls with non-immunized one.

According to official disease records maintained at the Mongolian Veterinary Service since 1931, outbreaks of rinderpest have decreased since 1933 as result of planned veterinary preventive measures in outbreak and high-risk areas. (Table 2)

Table 2

Number of diseased and dead cattle, 1931 – 1948

Year	Diseased	Dead	Year	Diseased	Dead/*Culled*
1931	-	-	1940	157	51
1932	10,273	10200	1941	24	22
1933	-	-	1942	54	52
1934	139	73	1943	175	92
1935	2	2	1944	108	84
1936	97	36	1945	1,899	*1,627*
1937	1,962	1,079	1946	204	*204*
1938	1,948	1,081	1947	12	*12*
1939	453	261	1948	14	*14*

(National Historic Archive F15 – D1 – PN 475, p. 100)

Sources of Infection and Modes of Transmission

There is no dedicated and comprehensive study in Mongolia on sources of infection and modes of transmission of rinderpest virus. However, the role of gazelle in rinderpest epidemiology is known for many outbreak cases. Dr. Maidar concluded in his doctoral thesis, presented in 1958, that rinderpest was most frequently introduced into Mongolia by gazelle during their migrations. A mass die-off of gazelle occurred in 1936-1938 and was first suspected and then explained as being rinderpest infection. A field expedition from the People's Commissariat of the Soviet Union (an earlier name) experimentally proved the susceptibility of gazelle to rinderpest in 1938 (Kurchenko,1995; Maidar, 1958).

Since animal-powered transportation from China to Mongolia had mostly come to end by the 1940's and a permanent guard established along the border to restrict movement of domestic animals, the only known factor for incursion of rinderpest was considered to be gazelle migration. As observed by Mongolian herders and veterinarians, rinderpest occurred mostly in the central part of the country when migrating gazelles arrived from the south. These animals had crossed the Gobi - desert areas with very few cattle - and are naturally shy of human contact. The sudden appearance of rinderpest in central parts of the country with no outbreaks between them and the nearest suspected source (China in those days) was therefore consistent with transmission by the migrating gazelles. It was generally agreed that bovine transmission through more favourable terrain would have left a trail of cases.

G. Dashnym G. (1998) noted in his book that Verteletski, L.A. and Shaburov observed characteristic clinical signs of rinderpest in yaks by the field challenge with tissue suspension from sick gazelles affected during a mass gazelle mortality in Baynkhongor, Uvurkhangai and Gobi-Altai in 1945.

Susceptibility of Yak and Khainag to Rinderpest

It is highlighted in the official veterinary records that the yak and khainag were overwhelmingly affected during rinderpest outbreaks with severe manifestation of clinical signs when no symptoms of the disease had developed in Mongolian cattle. Mongolian cattle, yak and khainag are commonly mixed into one herd in normal livestock farming. For example, in Bulgan province, estimated to have more than 20,000 cattle and almost 900 yaks in 1943, 97 yaks fell sick while no Mongolian cattle were affected during their last rinderpest outbreak.

In support of this observation, it was witnessed by local veterinarians that only yak and khainag populations were affected during the rinderpest epidemic that occurred in 12 soums (the current secondary administrative unit of Mongolia) of Arkhangai province that year.

The susceptibility of yak to rinderpest infection was clearly demonstrated in a field experiment made by a Russian veterinarian, Dr. N. I. Denisov, who worked at the Arkhangai biological manufacturing plant. In 1946, he challenged Mongolian red cattle and yak with infective pathological material derived from Mongolian gazelle and found that the yak developed the disease but Mongolian cattle showed no clinical signs.

An epidemiological survey in China showed that Mongolian cattle were most resistant to rinderpest with 50% to 70% mortality. Yellow cattle and buffaloes experienced 80% or more while Korean cattle and yaks suffered virtually 100 % mortality (Anon, 1997).

Rinderpest Sera and Vaccine Production and Use

Expanded operations at the anti-rinderpest serum production unit at Songino in the 1930's transformed it into the National Biologicals Production Institution – Biokombinat - which produced a number of biologicals for the country's needs.

In 1938, Biokombinat developed technology for the production of rinderpest dried tissue vaccine, under the guidance of Tassin and Delphy, and liquid rinderpest vaccine using Delphy and Jacota's procedure. Both of these had been studied between December 1938 and January 1939 with a wide-scale field challenge of 5.5 thousand cattle in Uvurkhangai province. As documented by Kojukhov (1941), this experimental vaccination programme yielded a promising outcome which allowed the Songino Biokombinat laboratory to manufacture a tissue suspension vaccine against rinderpest from 1941. For increased production of rinderpest vaccine to enable rapid elimination of the disease from the country, another biological manufacturing laboratory, dedicated to the production of rinderpest vaccine, was established in the centre of Arkhangai province in 1942.

A local virulent strain was used as a seed virus for the production of a formalinized tissue vaccine against rinderpest. Production techniques for this tissue vaccine consisted of:

- challenge yaks with a highly virulent virus strain
- collect and process affected organs – lung and spleen
- inactivate infective agents in the tissue with hydroxide aluminum and formalin mixture.

Vaccination scheme was immediate injection all cattle of the outbreak with hyperiimune sera and following vaccination. All cattle of nearby outbreak were vaccinated as well. Routine vaccination was applied in autumn where the rinderpest is prevalent.

Although the production of the vaccine had been executed under strict and costly restrictions and quarantine environment, there were instances of the infective virus escaping during vaccine production. However, as result of the increased vaccine production (Table 4), wide-spread annual vaccination (Table 5) and effective quarantine measures, generalized outbreaks (epidemics) of rinderpest were eradicated in 1945 and the few remaining isolated foci of infection were eliminated in 1949.

Archipov (1954) documented that the last outbreak of rinderpest at that time was detected in the surroundings of Eguzer Monastery, Sukhbaatar province, in 1948. No outbreaks were recorded between 1949 and 1991 when there was one l**Error! Reference source not found.** (Section 3).

Table 3

Production volumes of rinderpest hyperimmune sera and vaccine (1924-1960)

Year	Serum (L)	Vaccine (L)	Year	Serum (L)	Vaccine (L)	Year	Serum (L)	Vaccine (L)
1924	6,003		1937	0		1950	0	10,010
1925	6,507		1938	6,018		1951	0	8,592

1926	12,681	1939	8,487		1952	0	9,356
1927	416	1940	7772	892	1953	0	7,418
1928	0	1941	0		1954	0	4,154
1929	664	1942	2,485	4,582	1955	0	1,882
1930	1,067	1943	5,484	8,160	1956	0	2,085
1931	2,313	1944	0	8,382	1957	0	1,322
1932	987	1945	3285	10517	1958	0	810
1933	0	1946	0	10,350	1959	0	1,012
1934	0	1947	6,000	12,610	1960	0	435
1935	3,000	1948	1,887	13,600	1961	0	41
1936	0	1949	1,050	13,510			

Table 4

Numbers of immunized cattle

Year	Name of provinces where sera and vaccine were used for rinderpest control	Planned	Number of immunized cattle
1931	Arkhangai (formerly Tsetserleg-mandal), Khentii **		8,589[1]
1932	Dornod *Uvurkhangai		13,272
1933			41,528
1935	Uvurkhangai		1,902
1938	Selenge, Khuvsgul, Zavkhan, Uvs		41,323
1939	Arkhangai, Tuv, Zavkhan, Uvurkhangai		75,570[2]
1940	Arkhangai, Zavkhan, Uvurkhangai,		89640
1943	Uvurkhangai, Bayankhongor, Khentii**,		176764
1945	Arkhangai, Bayankhongor, Gobi-Altai, Dornogobi, Zavkhan, Uvurkhangai, Umnugobi, Sukhbaatar, Tuv, Khovd, Khuvsgul, Khentii**, Dornod * Bulgan		559680
1946	Arkhangai, Bayankhongor, Gobi-Altai, Dornogobi, Zavkhan, Uvurkhangai, Umnugobi, Sukhbaatar, Tuv, Khovd, Khuvsgul, Khentii**, Dornod *		490657
1947	Arkhangai, Bayankhongor, Gobi-Altai, Dornogobi, Zavkhan, Uvurkhangai, Umnugobi, Sukhbaatar, Tuv, Khovd, Khuvsgul, Khentii**, Dornod *		323,251[3]
1948	Arkhangai, Bayankhongor, Gobi-Altai, Dornogobi, Zavkhan, Uvurkhangai, Umnugobi, Sukhbaatar, Tuv, Khovd, Khuvsgul, Khentii **, Dornod *		155,682[3]
1949	Arkhangai, Bayankhongor, Gobi-Altai, Dornogobi, Zavkhan, Uvurkhangai, Umnugobi, Sukhbaatar, Tuv, Khovd, Khuvsgul, Khentii **, Dornod *	326,600	210,871[3]
1950	Arkhangai, Bayankhongor, Gobi-Altai, Dornogobi, Zavkhan, Uvurkhangai, Umnugobi, Sukhbaatar, Tuv, Khovd, Khuvsgul, Khentii **, Dornod *	305,700	241,967[3]
1951	Arkhangai, Bayankhongor, Gobi-Altai, Dornogobi, Zavkhan, Uvurkhangai, Umnugobi, Sukhbaatar, Tuv, Khovd, Khuvsgul, Khentii **, Dornod *	240,700	241,967[3]
1952	Arkhangai, Bayankhongor, Dornogobi, Zavkhan, Uvurkhangai, Umnugobi, Sukhbaatar, Khovd,	199,000	184,402[3]
1953	Arkhangai, Bayankhongor, Gobi-Altai, Dornogobi, Zavkhan, Uvurkhangai, Umnugobi, Sukhbaatar, Khovd, Khuvsgul	200200	129183
1954	Arkhangai, Bayankhongor, Gobi-Altai, Uvurkhangai, Umnugobi, Sukhbaatar, Khovd, Khuvsgul, Dornod *	150,000	100,711

1955	Arkhangai, Bayan-Ulgii Bayankhongor, Gobi-Altai, Umnugobi, Sukhbaatar, Dornod *	49,900	46,300
1956	Arkhangai, Bayankhongor, Gobi-Altai, Umnugobi, Sukhbaatar, Dornod *	50,000	33,200
1957	Arkhangai, Bayankhongor, Umnugobi, Sukhbaatar, Dornod *	13,200	15,620
1958	Arkhangai, Umnugobi, Sukhbaatar, Selenge, Ulaanbaatar	6,600	2,960
1959	Arkhangai, Umnugobi, Sukhbaatar, Selenge, Ulaanbaatar	6,100	5,180
1960	Arkhangai, Umnugobi, Sukhbaatar	3800	3100
1961	Arkhangai	4100	473
1962	Ulaanbaatar, Tuv	400	6614

Key: * = formerly known as 'Choibalsan', ** = formerly known as Khan-Khentii
[1] National Historic Archive F15 – D1 – PN 14, page 2
[2] National Historic Archive F15 – D1 – PN 119, page 5
[3] National Historic Archive F15 – D1 – PN 614, page 29

Following the rinderpest eradication, production of hyperimmune sera came to a close in 1949, although the vaccine production was continued for emergency rinderpest control.

The national vaccination strategy was also modified in August of 1948 with maintenance of vaccination of all cattle

- in a buffer zone averaging 200 km in width along the eastern and south-eastern borders to combat possible rinderpest incursions from China and
- in high risky areas, where the disease had occurred previously and yak and khainag are kept dominantly

The vaccination continued according to the established schedule of the Veterinary Service until 1963.

Besides the key importance of vaccination in successful rinderpest eradication in Mongolia, the implementation of a novel Decree by the Government of Mongolia, enforced in 1949, to cull all cattle showing clinical signs suggestive of rinderpest with cash compensation to livestock owners at a fixed Government value was a great innovation.

After 10 years' with no rinderpest outbreak, vaccine production was sharply reduced by the end of 1950's (Table 4). No vaccination was carried out between 1963 and 1991.

After reconstruction of the Songino Biokombinat plant with technical assistance from Hungary in 1973, rinderpest vaccine was produced experimentally (under Dr. L. Perenlei and Dr. Admashi Karoi) from the RBOK strain in primary calf kidney cells from 1977 (Perenlei L 2010).

3. THE LAST OUTBREAK OF RINDERPEST IN MONGOLIA – 1991-1992

Rinderpest was confirmed in the Tuva and Chita Republics of Russia on the northern border of Mongolia in the winter of 1991/92 indicative of an outbreak in yaks and cattle which spanned the border. Further outbreaks occurred further west along the Tuva border in 1992/93 (Figure 1). There was no indication that the disease had persisted there and the Mongolian authorities did not recognise the presence of the disease in the country. At the time it was suggested these outbreaks could conceivably be epidemic indicator areas of endemicity in yet undisclosed areas (Rweyemamu, 1996).

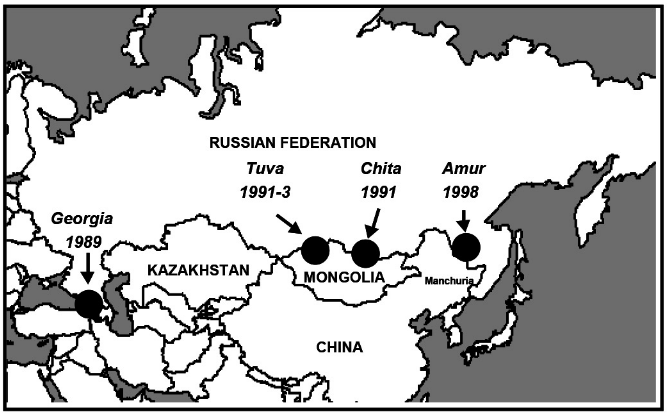


Figure 1: Map of the Russian Federation and some neighbouring countries illustrating the areas affected by rinderpest outbreaks (Roeder and Reichard, 1999).

Despite the lack of any evidence of persisting rinderpest, the disease occurred in Russia and Mongolia in the 1990s. In the absence of definitive answers, Russia, China and Mongolia knew themselves to be free from rinderpest whilst believing the other two to be harbouring infection (IAEA, 1999).

Rinderpest in a Russian cattle herd grazing in Mongolia

A herd of 1,516 cattle from a collective farm, Puti Ilyicha, Kyrin region, Chita Province of Russia, which were vaccinated against rinderpest between 25th April and 15th May 1991, (Batch 11 of K37/70). They were then moved to summer grazing in the Mongolian border area on June 11th, 1991 (Aleikin and Mishenko,1991). This was a well-established system of transhumance into a 110,000 hectare triangular area of Mongolia which is geographically separated from the rest of the country by mountains and two rivers, the Onon and Keren, and accessible only from the north – the Russian border side (Figure 2). The grazing area belongs to Bayn-Uul soum, Dornod province. At the time of the outbreak it had only been used by Russian graziers for at least 10 years according to bilateral agreements between the Russian and Mongolian local authorities (Sodnomdarjaa, 1998).

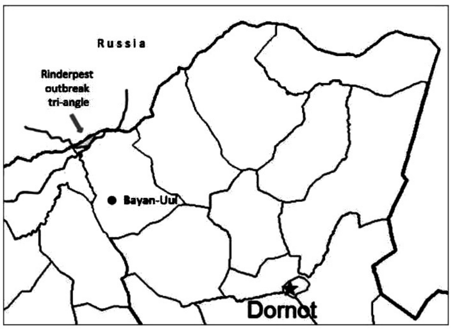


Figure 2. Location of rinderpest outbreak in Russain cattle herd (July 1991)

On July 5th, 1991, the first deaths were noted in the Russian cattle herd in Mongolia (Aleikin and Mishenko, 1991) and over a period of three weeks some 174 of 1,205 cattle grazing in the triangle developed illness. Of these 110 died (64% case fatality rate). The signs of disease (lethargy, anorexia, fever, salivation, oral erosions, diarrhoea - sometimes blood-stained) were highly suggestive of rinderpest as were lesions of erosive stomatitis, inflammation of the mucosa of the rumen, omasum, abomasum and intestines plus hyperaemia of the Peyer's patches and mesenteric lymph nodes. Initial laboratory diagnostic investigations were conducted by staff from Chita with end of sequential uncertainty until staff from the Kazakhstan Laboratory collected samples on July 27th, confirming rinderpest by a complement fixation test although the method used leaves some doubts as to the validity of the result (Roeder and Reichard, 1999). Other investigators concluded that the disease observed belonged to the bovine virus diarrhoea/mucosal disease (BVD/MD) syndrome (Provost, 1991). All cattle in the Russian co-operative farm (some 6,200 in all) were vaccinated with K37/70 vaccine (Batches 11 and 12) between 29th July and 3rd August (Aleikin and Mishenko, 1991).

The Mongolian veterinary authority was informed of the livestock deaths and the rinderpest outbreak in Russian cattle herd on August 3rd, 1991, almost one month after the first deaths of Russian cattle on Mongolian territory. At that time, neither rinderpest, nor any other infectious disease that could lead to such mass livestock death, was registered anywhere in Mongolia.

Notification of the rinderpest outbreak in the Russian herd, resulted in clinical examination in all cattle herds of Bayn-Uul and other soums in Dornod province. However, no case of suggestive of rinderpest was detected. Vlasov and Melinikov (1991) note down in their report that 311 cattle of Russian origin, which had been moved deep (130 km) into Mongolian territory for better grazing since June 16th, had not developed any disease sign and remained healthy. These facts confirmed that rinderpest only occurred in the Russian herd which had stayed in the triangle. However, in line with disease notification requirements within its territory, this outbreak of rinderpest in the Russian herd was informed to OIE as it had occurred in Mongolia.

Rinderpest incursion with Tuva yak into Mongolia

In October 1991, signs suggestive of rinderpest were observed in domestic yaks 'on farms' in Tuva Republic of Russia, over 1,000 km away from Chita (Semenikhin *et al.*, 1995). Subsequently, rinderpest virus was identified by a variety of techniques at two independent institutes in Russia. Tuva is adjacent to the Russia-Mongolia border but Mongolia was not informed of this Tuva outbreak.

Despite the outbreak, collective farm "*Sixty Years of Soviet Union*", in Munguntaiga region, Tuva Republic, Russia dispatched in November, 1991 more than 2000 yaks to winter pasture on the adjacent Mongolian mountains in Sagil soum, Uvs province due to harsh winter snowfall (23).

On December 10th, 1991, the first information about mortality among Tuva cattle in Mongolia was received from the Mongolian border security port "Doloon Tolgoi". Subsequent visits to Tuva herders still present in the Mongolian border area by Mongolian veterinary officials from local and central authorities, December 11-16th, with clinical and pathological examinations recorded mass death of Tuva yaks. Malignant Catarrhal Fever was suspected at first and then Rinderpest (Oidov and Khukhuu, 1991). At the time of the visit, the pasture of Sagil soum, Uvs was contaminated with more than 200 frozen carcases of Tuva yaks.

According to interviews with veterinarians of Tuva Republic and Russain Veterinary Services, during the meeting of Mongolian (headed by CVO, Mongolia, Dr. L. Dorjsambuu) and Russian (headed by vice-Minister of Agriculture of Tuva) officials, held in Muhur Aksy, Mungun-taiga region, Tuva Republic, 25 December, 1991, it was clarified that clinical signs of infectious disease among Tuva yaks started at the end of September in collective farm "*Sixty Years of Soviet Union*", located 35-40 km away from the Mongolian border (22). Mass death of yaks occurred; for instance, up to 33 yaks died in one herd. In total, 313 yaks had died by December 11th in the Munguntaiga region of Tuva (Oidov and Khukhuu, 1991).

Based on the decision by the State Emergency Commission of Mongolia, released December 21, 1991, a Mongolian working group required Tuva to take back all its cattle and clean-up the environment by removing all carcases from the Mongolian border area before January 5th, 1992. As noted in the report by the Mongolian monitoring group on January 16th, 478 yak carcases were carried back to Tuva while 155 carcases remained in the Tsagaan gol and Mergen areas. This data shows that approximately 30% of the Tuva yaks died during the rinderpest outbreak in Mongolia in December of 1991 and January of 1992. H. Yu. Romanovich, a representative of the Soviet Union at the Mongolian Ministry of Agriculture visited the rinderpest outbreak area on January 16th, 1992, together with the Mongolian Chief Veterinary Officer L.Dorjsambuu and witnessed that no Mongolian cattle from Sagil and Davst soums were affected with the disease - Sagil and Davst soums had no yak which are commonly more susceptible to rinderpest.

However, in 24 January, 1992, deaths were recorded among yak in Gurvan Jigertei bag, Bukhmurun soum, Uvs province, adjacent to Sagil soum. Rinderpest infection was confirmed by several laboratory techniques such as IFA, cell culture, VNT and a challenge to bovines at biosecurity-enhanced laboratory in Ulaanbaatar. Clinical material was collected from yaks in the second outbreak in Uvs and 8 yaks were inoculated subcutaneously with a suspension of the material. Two yaks vaccinated with TCRV RBOK strain and two yaks vaccinated with K37/70 showed no clinical symptoms. Two controls died at day five with typical symptoms of rinderpest which commenced 24 hours after inoculation. Two yaks vaccinated with BVD vaccine (live vaccine) showed mild clinical symptoms, suggestive to rinderpest.

The disease spread then to adjusent Nogoon nuur soum of Bayan-Ulgii province (only 7 km between centers of Bukhmurun and Nogoonnuur soums) and continued until June, 1992 (Figure 5). Strict quarantine were imposed in Bukhmurun and Nogoonnuur soums in order to contain the infection on area of outbreaks. Rinderpest caused the deaths of 267 yaks but no deaths in Mongolian cattle kept in the same herds in Mongolian territory adjacent to Tuva between February and May, 1992. Overall in Tuva and Chita, mortality amounted to some 2,500 yaks and 10,000 cattle *(25).*

Several meetings were held in Munguntiag region, the Khandgait border town and Kysil city, Tuva Republic, in February and March of 1992 between the Mongolian and Tuva working groups plus Government officials. They discussed rinderpest control, border security and the veterinary sanitary measures to be taken in the outbreak area.

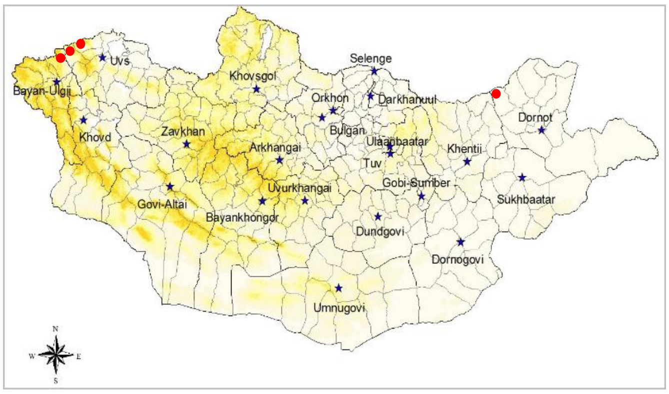


Figure 3. Map of last rinderpest outbreaks in Mongolia *(Red dots are outbreak areas)*

Rinderpest virology and viral sequences

Tissues from yaks affected in Tuva, Russia were submitted to Pirbright Laboratory, UK, for examination. These were found to be positive for rinderpest precipitin and nucleic acid by hybridisation and RT-PCR. F gene sequencing gave results which were interpreted to indicate the presence of two unrelated viral sequences, one being a virus of the Asian lineage and the other being identical to the RBOK vaccine strain (Roeder and Reichard, 1999)

At the time it was thought that K37/70 and RBOK vaccine strains were related but this is now known not to be the case. Although only a 280 nucleotide sequence is available (rather shorter than the 320 nucleotide sequence routinely used for comparison), it is clear from subsequent work that one sequence is virtually identical to that of the Kabul (Afghanistan 1961) isolate and therefore the K37/70 vaccine virus. The presence of the RBOK sequence in Tuva is difficult to understand unless it is perhaps related to the use of an RBOK vaccine in Mongolia.

Unrecognised long-term persistence of rinderpest virus in domestic livestock or wildlife in the region is a very remote possibility. Several hypotheses were proposed to explain the events observed in Chita and Tuva (Roeder and Reichard, 1999)

a. *Spread from an area of unidentified persistence within the Russian Federation*

There was no reason to suspect unrecognised rinderpest persistence in Russia, the whole of the territory had essentially been free from the disease for more than 60 years.

b. *Spread from persisting infection in Mongolia and other neighbouring countries*

The disease had not been present in Mongolia since 1949; China was considered to have been free since its eradication in 1955 and Central Asia since the 1950's.

c. *Initiation of outbreaks by the use of K37/70 vaccine*

Tissues collected from yaks in Tuva contained a rinderpest virus nucleotide sequence similar to that of the Kabul (Afghanistan 1961) virus and the K37/70 vaccine virus.

Hypothesis and reality in Mongolia

According to observations and local reports, there was no contact, direct or indirect, between Mongolian and Russian livestock when the latter grazed on the geographically separated triangle pasture of Bain-Uul, Dornod province, Mongolia in June-July 1991. There was also no other rinderpest occurrence in the whole province in 1991.

However, Mongolia was blamed as the source of the infection by the report of Russian veterinary officials (Vlasov and Melinikov, 1991). According to their report, the rinderpest was contracted in Dashbalbar soum, Dornod province, as the officials "heard" about it from local Russians who "heard" about it from Mongolians. Their report does not use a science-based epidemiological survey, field examination nor laboratory diagnostic testing.

Another hypothesis proposed that the vaccine administered in Chita gave rise to clinical rinderpest in the cattle after they had moved to pasture in Mongolia where local Mongolian cattle became infected, the infection spread through northern Mongolia to infect yaks in western Mongolia and then crossed back into Russia (Roeder and Reichard, 1999). However, there was no local contact due to geographical separation and no Mongolian cattle grazing south of the wide Onon river fell sick during this outbreak, confirmed by many clinical examinations of all cattle in the surrounding Bayn-uul soum, Dornod province. A distance between Dornod and Uvs provinces is near to 2,000 km away across rugged terrain and not a normal movement route in Northern Mongolia and no rinderpest nor suspect cases were detected in the whole of Mongolia until December 1991 which almost certainly precludes this from being a worthy hypothesis.

Rinderpest apparently entered Mongolia when a infected yak from Tuva crossed the border and infect yaks in the western Mongolia in 1992. Russia claims it was a sick yak from Mongolia that introduced the disease to their livestock. Yaks which contracted rinderpest at Tuva (more than a thousand kms away from Chita) had earlier been at grazing in Mongolia where rinderpest was seen in 'feral/wild yaks' (IAEA, 1999). However, Mongolia does not have feral yak or even wild yak!

In order to explain these enigmata, scientists hypothesized about the roles that deer and gazelles could play in maintaining rinderpest in the region. Russian scientists also proposed s*uroks* and *susliks* (rodents of the genera *Marmuta* and *Citellus* respectively) as potential hosts and a means of virus introduction across a heavily guarded border with China, their susceptibility to laboratory infection having been established. However, it is unlikely that any of the wild fauna could have sustained rinderpest virus for 50 years without its presence being shown in local cattle and wild ungulates (Roeder and Reichard, 1999).

A later rinderpest outbreak in 1998 involved a single village in the Amur region of the Russian Far East close to the border with China, but separated from it by the broad Amur River, fortifications and severely enforced movement restrictions. It occurred more than 1,500 kms from the eastern Mongolian border and suggests answers to the previous hypotheses on the source of rinderpest infection, shattering the belief that one of the neighbours was harbouring infection.

It is clear from reports that there was some diagnostic confusion between rinderpest and the bovine viral diarrhoea/mucosal disease (BVD/MD) syndrome. A. Provost (1991), OIE expert, who had mission in Dornot province, Mongolia on 5-22, 1991, noted in his report that the disease occurred in Bayn-Uul, Dornot was reminiscent more of the sub-acute form of mucosal disease than rinderpest, based on epidemiological investigation and also histological examination (tissue samples were collected from dead cattle in outbreak area in 5th August, 1991), which showed a necrosis of the lymphoid follicles of the spleen, discrete sub2acute myocarditis, an acute mesenteric lymphadenitis with follicular necrosis and normal appearance of the samples of the large intestine (Fontaine J. J.1991).

Another report mentions that BVD "might be clinically manifest from time to time, as (for example) among yaks in the Moron Region in 1990" *(25)*.

The three incidents in Chita, Tuva and Amur areas of the Russian Federation were associated with the vaccination buffer zone which had been maintained in border areas of the USSR from the Pacific Ocean to the Caspian Sea. The vaccine in use was derived by attenuation of the Kabul 1961 virulent strain of rinderpest virus which is designated K37/70 (Dr Sergei Starov, personal communication cited in IAEA, 1999).

Molecular characterization of the K37/70 virus and that isolated from the Amur Region outbreak demonstrated a very close relationship between them (Roeder and Reichard, 1999, relating the work of Drs Sergei Starov and Pavil Ayanot of the All Russia Research Institute for Animal Health, Vladimir, Russia). Within a 321 nucleotide section of the F gene examined, the viruses are identical except for one substitution. Both these viruses also share a single substitution of another nucleotide with the progenitor Kabul 1961 virus. Conclusively, perhaps, sequencing or partial sequencing of viruses derived from the Tuva and Georgia (1989) outbreaks also demonstrate a very close relationship with the K37/70 vaccine virus (Barrett *et al*., 1993.

Although extensive *in vivo* testing had never disclosed a tendency to regain virulence, it is believed that the outbreaks occurring in the vaccination buffer zone of the USSR/Russian Federation between 1989 and 1998 resulted from reversion to virulence of the vaccine virus that was administered to the animals in Russia (IAEA,1999).

Emergency vaccination and the vaccine used

For nearly 30 years, before the 1991 rinderpest in Russia, Mongolian cattle were not vaccinated against rinderpest, even though RBOK rinderpest vaccine was produced at Songino Biokombinat for emergency use - averaging 50,000 doses annually.

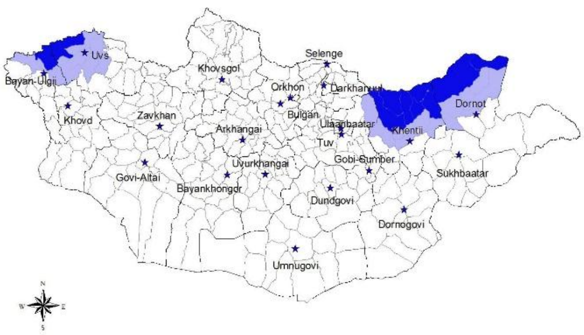
Confirmation of the rinderpest outbreak in the Russian herd in July, 1991, initiated emergency vaccination to protect Mongolian livestock. At first, around 1,000 cattle of BaynUul soum, Dornod, grazing in the vicinity of the triangle outbreak were vaccinated using Russian K37/70 vaccine from Batch 11 from 13th August (the name of the manufacturer on the vaccine label was unclear). Vaccination was discontinued on August 26th due to suspicion of possible reversion to virulence of the vaccine virus.

All cattle of Bayn-uul, Bayndun, Dashbalbar and Ereentsav soums of Dornod province and Dadal, Norovlin, Binder and Umnu delger souns of Khentii province were vaccinated with RBOK TCRV vaccine, produced in Songino Biokombinat inside a week in September, 1991. The Biocombinat, Ulaanbaatar is the only vaccine production site in Mongolia. The RBOK strain used in the Biocombinat was provided from the Institute for Sanitary and Prophylaxis, Budapest, Hungary. The vaccine is quality controlled by the State Veterinary Drug Testing and Certification Laboratory. It is freezing dried and produced on primary calf kidney cells.

Following a confirmed outbreak of rinderpest in western Mongolia, all yaks and cattle in the affected and surrounding soums, where yak is widespread were vaccinated with RBOK TCRV in February and March 1992. No K37/70 vaccine was used in this outbreak.

Vaccination was carried out by the public veterinarians of the affected soums and it was supervised by the provincial veterinarians who were also responsible for the distribution of the vaccine. The vaccination was compulsory and free of charge. The animals vaccinated were recorded but individual animals were not marked. No cases suggestive of rinderpest were observed after the emergency vaccination in either high-risk area.

Vaccination with RBOK-TCRV from Biokombinat, Mongolia continued until September, 1997 (Table 5) when all vaccination against rinderpest was stopped. No animals which had been vaccinated against rinderpest entered the country after vaccination was stopped.



(Key - light blue - vaccinated area in 1991-1993 and dark blue – 1991-1997)

Figure 4. Vaccination was carried out between 1991 and 1997 in the border soums of the three provinces with high-risk of rinderpest incursion and transmission.

Table 5

Vaccinations against rinderpest in Mongolia (1991-1997)

Year	Name of districts vaccinated	Estimated population in particular area/provinces	No. Vaccina tions	Level of vaccinatio n (%)
1991	- Bayan Uul of Dornod province	10314	1000*	9.6
1991	- Bayan Uul, Bayandun, Dashbalbar, Ereentsav, Tsagaan-ovoo of Dornod province - Norovlin, Binder, Dadal, Umnudelger of Hentii province	562531	89900	15.6

1992	- Bayan Uul, Bayndun, Dashbalbar, Ereentsav, Tsagaan ovoo of Dornod province, - Norovlin, Binder, Dadal, Batshireet, Umnudelger of Khentii province, - Buh murun, Sagil, Turgen, Davst, Khovd, Tarailan of Uvs province, - Nogoon Nuur, Altantsugst, Ulaankhus of Bayanulgii province.	544869	290500	53.3
1993	Same as above	514045	246,700	48.0
1994	- Bayan Uul, Bayndun, Dashbalbar, Ereentsav of Dornod province, - Norovlin, Binder, Dadal, Umnudelger of Khentii province, - Buh murun, Sagil, Davst, of Uvs province, - Nogoon Nuur of Bayanulgii province.	553548	128200	23.1
1995	Same as above	591421	129,500	21.8
1996	Same as above	610228	126900	20.7
1997	Same as above Last vaccination in September	639618	129400	20.1

Key: *- vaccine - K37/70, Russia

The Biocombinat continues to produce RBOK-TCRV vaccine till 2005 (Table 6) , which is kept in store and destroyed after the expiry of the shelf life. No rinderpest vaccines are distributed in the country. The seed RBOK strain is kept now in Songino Biokombinat under strict biosecurity conditions for possible production of emergency stocks of rinderpest vaccine.

Table 6

Doses of rinderpest vaccine produced annually by Biokombinat (1991-2004)

Year	Number of doses	Year	Number of doses
1991	115900	1998	105500
1992	260000	1999	18000
1993	272600	2000	102000
1994	56000	2001	110000
1995	152000	2002	75000
1996	161700	2003	62700
1997	149500	2004	52000

4. STRATEGY TOWARDS THE FINAL DECLARATION OF FREEDOM FROM RINDERPEST INFECTION

The control and eradication program for rinderpest in Mongolia till ceasing rinderpest vaccination in 1997 were based generally on early detection of rinderpest, vaccinations and quarantine in the case of outbreak. Sequential activities had been taken since 1999 to complete OIE pathway to achieve an international declaration for rinderpest infection freedom in Mongolia, which were consisted of:

- strengthening veterinary service and laboratory competence for improved performance of diagnostic and surveillance activities,
- clinical and serological surveillance for confirmation of absence the disease, as well as rinderpest virus infection in whole country,
- prevention of reintroduction of rinderpest
- preparation of contingency plan for emergency control of trans-boundary animal disease.

Clinical and serological survey in 2000 – 2004

The specific rinderpest clinical surveillance was carried out in connection with countries–wide three clinical and serological surveys in 2000, in 2002 and in 2004. No evidence for clinical signs suggestive of rinderpest was found during these three surveys. Clinical and laboratory investigations (Table 7) following reports of erosive diseases in 2000-2004 identified rapidly BVD or IBR and FMD of the country in 2000 – 2001. The erosive disease in cattle, which occurred in July 2002 and February 2004 were also rapidly identified as FMD and eradicated using stamping out and ring vaccination. A total of 12.463 sera from cattle (9790), sheep (1167), goats (1021) and camel and horses (485) (Table 7) from 71 soums from 14 aimags which bordered Russia and China were sampled. The herds were the sera were collected were also inspected for any clinical signs of rinderpest. Sampling age was 2-6 years. In some areas older animals up to 10 years might have been included in the sample.

Table 7

Details on sample numbers and sampling frame carried out in 2000

Name of aimag	Number	Cattle			Sheep			Goat			Horses and Camel		
		tot. in 1000	exp.	Sampled	tot. in 1000	exp.	sampled	tot. in 1000	Exp.	Sampled	tot. in 1000	exp	sampled
Bayn-Ulgii	7	86,4	1295	1300	482.0	239	240	351,8	172	170	50,5	50	50
Baynkhongor	2	1,4	20	20	46,9	22	20	176,4	88	80	12,8	12	12
Bulgan	2	25,2	378	380	40,2	19	20	12,6	5	5	15,3	15	15
Gobi-Altai	5	19,2	287	285	269,8	132	132	314,5	146	146	30,5	-	-
Dornod	9	73,8	1104	1100	187,5	90	90	48,2	18	20	29,5	29	29
Zavkhan	1	6,5	97	95	36,4	18	20	31,6	16	15	5,7	-	-
Umnugobi	7	14,6	247	240	170	81	80	450,1	223	220	79,4	79	79
Sukhbaatar	5	68,1	1020	1020	243,4	119	120	123,0	60	60	64,2	64	64
Selenge	5	20,1	300	-	71,5	34	-	17,1	9	-	7,1	-	-
Uvs	6	65,2	979	1000	249,3	123	120	114,8	55	55	37,7	37	37
Khovd	4	22,3	333	330	103,7	51	50	123,9	60	60	16,7	16	16
Khuvsugul	8	167,3	2505	2500	313,8	152	150	169,7	82	80	102,	100	100
Khentii	5	58,1	871	870	80,4	38	40	48,8	24	25	26,5	25	25
Dornogobi	6	43,5	651	650	177,0	85	85	175.0	85	85	53,1	53	53
Total	71	671,7	1087	9790	2471,9	1203	1167	2157,5	1043	1021	531	485	485

The sera were tested in the RP H cELISA using a cut-off of 50% PI. After the retesting of 745 sera which were identified for retest or which were initially positive, 40 cattle sera had PI values >50%. All sera were traced back to animals >8 years and no animals <8 years were positive.

Follow up investigations in the 8 soums where positive sera were detected were carried out in July/August 2002 and a total of 336 sera from cattle (276) and in locations where not sufficient cattle were available also from sheep (40), and goats (40) were collected and tested. From the 40 cattle which were positive in the 2000 survey only 5 could be retraced during follow up investigations in 2002, e.g. from the sera collected in 2000 in Bayn-Uul in one herd, one 10 year old cow was positive. Follow up investigation in the same herd in 2002 showed again 3 positives out of 101 cattle, a 10 year old and a 12 year old cattle and the cow which was already previously tested and which was now 12 years old. Since no animals born after vaccination were positive it was concluded that the positive sera were due to vaccination.

A total of 4230 sera from cattle (2210), sheep (965), goats (565) and camel and horses (490) (Figure 5 and Table 8) from 45 soums from 4 central aimags which are the most populous indicated through blue marks were sampled. No vaccination had been carried out in these provinces. The herds where the sera were collected were also inspected for clinical signs of rinderpest. Sampling age was 2-6 years. The sera were tested in the RP H cELISA using a cut-off of 50% PI. No positive animals were found (Table 9).

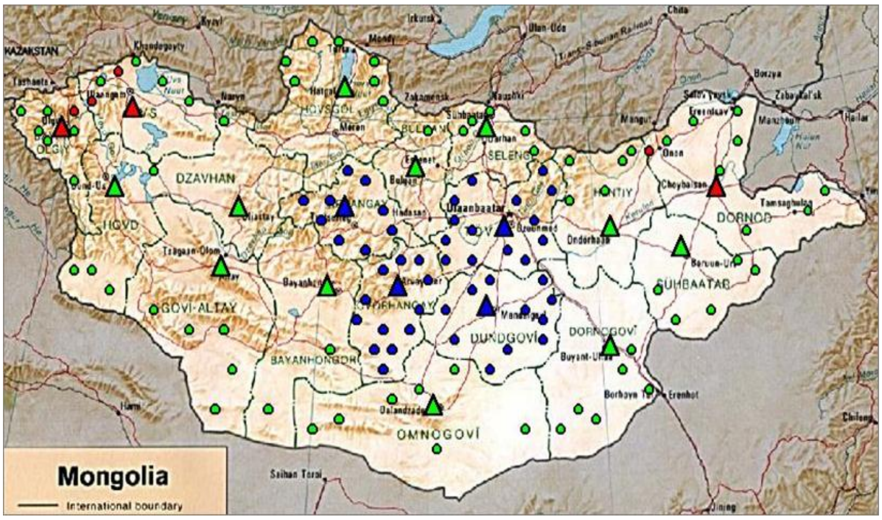


Figure 5. Same as above showing the 45 soums where the sampling in 2002 was carried out.

Table 8

Details on sample numbers and sampling frame carried out in 2002

Name of aimag		Cattle			Sheep			Goat			Horses and Camel		
		tot. in 1000	exp.	Sam	tot. in 1000	exp.	sampled	tot. in 1000	Exp.	Sampled	tot. in 1000	exp	sampled
Tuv	14	144,6	693	690	641,8	324	330	259,4	147	145	179,	170	170
Dundgobi	11	103,2	455	460	699,7	334	335	615,7	298	290	183,	180	180
Uvur khangai	11	170,3	841	-	793,4	346	-	616,5	309	-	174,	170	-
Arkhangai	9	212,0	1060	1060	490,3	316	300	230,1	133	130	141,	140	140
Total	45	630,1	3049	2210	2625,2	1320	965	1721,7	887	565	677,0	660	490

Table 9

Test results from 2000 and 2002 survey

Name of provinces	Number of soums	Number of sera	Species	Number of sera	(Retests) final positives	
Gobi-Altai	5		Cattle	870	(±225) +7	863
Khuvsugul	4	1135	Sheep	110	-	110
Dornod	5		Goat	155	-	155
Khuvsugul	4		Cattle	2010	(±230) +17	1993
Zavkhan	1	2314	Sheep	175	-	175
Khentii	2		Goat	129	-	129
Khentii	3		Cattle	2110	(±175) +11	2099
Bayn-Ulgii	7	2420	Sheep	165	-	165
Zavkhan	1		Goat	145	-	145
Dundgovy	6	4360	Cattle	3471	(±115) +5✷	3466
Uvs	1		Sheep	484	-	484
Khentii	4		Goat	405	-	405
Dornod	2					
			Cattle	8461	(±745) +40	8421
Total		10229	Sheep	934	-	934
			Goat	834	-	834

A total of 745 sera had to be retested, leaving 40 sera positive. The locations and herds with positive animals were followed up (Table 10).

Table 10

Follow up investigations and resampling of herds and animals which were positive in the 2000 survey.

Province	Soum	Sera			Positive	Negative
Uvs	Sagil, Bukhmurun	156	Cattle	76	(5)-2r	71
			Sheep	40	-	40
			Goat	40	-	40
Dornod	Bayndun, Bayn-Uul	101	Cattle	101	(3)-1r	98
Khentii	Norovlin, Dadal, Binder Umnudelger	99	Cattle	99	(7)-2r	92

No positive results were found in the 2002 survey in the central aimags. Only 5 of the 40 animals (marked with “r”)which were positive in the first survey could be identified and resampled.

In locations where not enough cattle were available sera from sheep and goats were collected. All cattle which were positive were cattle older than 6 years.

Serological survey in 2004

The clinical and serological survey was designed with sample numbers sufficient to detect rinderpest infection with at least 95% confidence if 1% of the herds would be infected.

The sampling frame has been designed as a randomised multistage cross-sectional sampling frame. Complete lists of the bags are available at the veterinary department and in each of the two strata 314 bags were selected randomly from a total of 1701 bags. There are a total of 1012 bags in the Northern Stratum and 689 in the Southern Stratum. Within each *bag* one herd was selected randomly and sera were collected from 18 cattle, which were also selected randomly.

More than 13 years had passed since the last outbreak of rinderpest in the Northern stratum occurred and it can be safely assumed that any circulating rinderpest virus would have infected a sizeable proportion of animals in an infected herd and also within the *bag*. Any outbreak of clinical erosive disease within the herd would be reported and detected. The probability that rinderpest antibodies as a result of circulating virus would have been detected in any herd is above 95%. The same probability would probably be also achieved if any other herd in the *bag* were infected. Based on the sample size and the overall number of *bag*s this would result in an overall probability of detecting rinderpest if it would be there which is above 97%.

At the Veterinary Research Institute the sera were tested in the RP H cELISA using a cut-off of 50% PI. No positive animals were found (Table 11).

Table 11

Test results of the serum samples collected from cattle, sheep and goat

Province	Number of Soum	Number of bag	Serum ID number	Total number of serum	Cattle	Sheep and goat	Result of Elisa: False Positive	Result of Elisa: Negative	PI av
Arkhangai	17	28	01-504	504	420	84	23	481	32
Bayan Ulgii	12	25	505-954	450	375	75	1	449	23
Bulgan	13	21	955-1332	126 *	105	21		126	47
Dornod	11	22	1333-1728	396	330	66	8	388	40
Zavkhan	25	35	1729-2358	630	525	105	19	611	39
Uvurkhangai	17	36	2359-3006	648	540	108	29	619	42
Sukhbaatar	11	22	3007-3402	396	330	66	34	362	36
Selenge	10	11	3403-3600	196	165	33		198	24
Uvs	15	28	3601-4104	504	420	84	21	483	29
Khuvsgul	19	40	4105-4824	720	600	120		720	28
Khentii	14	30	4825-5364	540	450	90	8	532	45
Darkhan Uul	4	10	5365-5344	180	150	30	1	179	37
Orkhon	2	6	5545-5652	108	90	18		108	27
Total I strata	*165*	*314*	*01-5652*	*5400*	*4500*	*900*	*144*	*5256*	*34.5*
Bayankhongor	19	46	5653-6480	828	690	138	17	811	39
Gobi-Altai	14	39	6481-7182	702	585	117	19	683	43
Dornogobi	14	24	7183-7614	432	360	72		432	28
Dundgobi	14	32	7615-8190	576	480	96	1	575	32
Umnugobi	14	25	8191-8640	450	375	75	14	436	39
Tuv	26	55	8641-9630	990	525	165	37	953	41
Khovd	17	40	9631-10350	720	600	120		720	43
Ulaanbaatar	9	50	10351-11250	900	750	150	12	888	44
Gobisumber	2	3	11251-11304	54	45	9		54	40
Total II strata	*129*	*314*	*5653-11304*	*5652*	*4710*	*942*	*100*	*5552*	*38.7*
TOTAL	294	628	01-11304	11052	9210	1842	244**	10808	36.2

* Totally 252 serums (14 bag of Bulgan province) not qualified the sera standards, not available to investigate
** Subsequence of first investigation showed positive, and retested investigation showed negative

Rinderpest surveillance in other species than cattle susceptible to rinderpest

Serum samples from sheep and goats were collected in locations where not enough cattle were available during the 2000, 2002 and 2004 serological surveys. Only two species of the order artiodactyla occur in substantial numbers in Mongolia. These are white-tailed gazelle, zeer, (*Procapra gutturosa*, estimates in 2003 >1.5 million) and black tailed gazelle (*Procarpa gutturosa gutturosa/subgutturosa,* in 2000 approx. 150.000). A number of sera were collected from white-tailed gazelle tested in the H cELISA for antibodies to rinderpest virus. No indication of infection of this species was found (Table 12).

The Northern part of Mongolia, a group of people keeps around 240 domestic reindeer. A number of sera were collected from domestic reindeer tested from Northern part of Mongolia.

Table 12

Test results for rinderpest antibodies in the H cELISA, white-tailed gazelle-zeer, *(Procapra gutturosa)* and reindeer *(Ranjiper trandus)*

Province	Soum	Sampling date	Rinderpest H cELISA		
			Total serum	Tested	Result
		Gazelle			
Sukhbaatar	Bayandelger	Feb 2004	6	6	Negative
Dornogobi	Altanshireet	Feb 2004	8	8	Negative
	Delgerekh	Feb 2004	7	7	Negative
	Urgen	Feb 2004	6	6	Negative
Total			27	27	Negative
		Reindeer			
Khivsgel	Ulaan Uul	Aug 2004	39	39	Negative
Total			66	66	Negative

Table 13

A list of active surveillance in 2000-2004

Year	Population surveyed	Estimated population	Serum tested	Survey results
2000	71 soums of 14 provinces		12463	745 sera were positive due to vaccination antibody
2002	45 soums of 4 provinces		4320	No positive animals
2002	77 soums of 17 provinces		356	Retested positive sera 2000-2002 5 samples were positive
2004	I strata – Herd of cattle and small ruminants - 5400		5400	By retesting, 144 positives of first investigation was negative
2004	II strata - Herd of cattle and small ruminants - 5652		5652	By retesting, 100 positives of first investigation was negative
2004	Wildlife - 5		66	Negative

OIE recognition of freedom from rinderpest in Mongolia

Based on the fact that:

- the last outbreak of rinderpest in Mongolia occurred in 1992,
- the last vaccination against rinderpest was carried out in 1997,
- the random clinical and serological surveys were undertaken in 2000 and 2002 for rinderpest disease freedom confirmation
- Mongolia was recognised by the OIE in 2004 as rinderpest diease free country, and
- the countrywide randomised clinical and serological surveys were completed in 2004 for rinderpest infection freedom confirmation to compete the OIE pathway,

Mongolia's application of freedom from rinderpest infection were approved and certified by OIE General Session in May 2005, based on the recommendations of Ad hoc Group on Evaluation of Country Status for rinderpest (Doc. 73SG/12/CS3 B/AHG 9).

Support of international organisations

The number of international projects were implemented in Mongolia to assist Mongolia's effort to strengthen diagnostic and surveillance competences of veterinary laboratories, broad scale survey for confirmation of rinderpest disease and infection freedom and develop the dossier for recognition rinderpest free status of the country (Table 14).

Table 14

A list of international projects, focused to rinderpest issues

Project	Year	Invest ment USD	Outputs in relation to rinderpest eradication, infection freedom confirmation, declaration and maintanance
IAEA – MON/5/012 and MON/5/013 Diagnosis and surveillance of transboundary animal diseases and production of diagnostic reagents	2000-2004	600000	strengthen sero-surveillance capabilities to achieve Rinderpest free status of the country or specific zone surveillance results obtained by testing near to 30 thousands of serum samples of domestic and wild animal (Table16) demonstrated freedom from rinderpest infection
GREP-FAO and IAEA TCP MON/5/012	October 2003	15000	organization of "National Workshop On The Diagnosis And Surveillance Of Transboundary Animal Diseases", which was instrumental to achieve an international recognition of freedom from rinderpest disease
FAO TCP/MON/3101, “Strengthening Early Warning for Transboundary Animal Disease Diagnosis”	2006-2009	378 000	surveillance results obtained by testing near to 10000 samples confirmed the country status of rinderpest infection freedom, obtained in 2005 improved technical and management capacity in epidemiological analysis

CONCLUSION

The history of rinderpest in Mongolia is lengthy and barely reflects the tragic loss of animal life over centuries nor the extra hardships that loss imposed on a nomadic people who rely on their cattle for inputs into every facet of their daily life.

Structured action of veterinary service to control rinderpest, which were widespread in Mongolia in the first half of 20th century resulted elimination of infection until incursion of infection in 1991-1992, which were eradicated by well designed control strategy with strict quarantine and effective vaccination.

By the concerted effort with the co-operation of FAO, IAEA, and OIE on implementation of required activities in an accordance with the OIE Pathway, Mongolia approached its goal to have international recognition as rinderpest infection free country in 2005.

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