Veterinary expeditions of Central and Eastern European countries against brucellosis, tuberculosis and glanders in Mongolia: a historical report

V. Kouba
Honorary Member of the CENTAUR International Advisory Board
Former Chief, Animal Health Service, Food and Agriculture Organization of the United Nations

Abstract

A three-year international programme against animal tuberculosis, brucellosis and glanders in Mongolia, diseases causing enormous losses in animal production and affecting human population even with fatal outcomes, was prepared for the period following the eradication of foot-and-mouth disease in 1964. The aim was to use mass screening to discover all herds affected by these dangerous infections transmissible to man and to initiate particular control programmes. The programme was approved by an international scientific-methodological conference held in Ulaanbaatar, 4-12 March 1965. Five countries of Central and Eastern Europe participated in the programme on a voluntary bilateral basis. During 1966-1968 in all 16 Mongolian provinces there were carried out 37 657 595 specific tests following by the commencement of recovery procedures. Ratios of the number of tests to the number of animals of selected species were as follows: tests on glanders in horses reached 2.48 and in camels 0.53; tests on brucellosis in camels reached 0.69, in cattle 1.42, in sheep 1.53 and in goats 1.37; tests on tuberculosis in cattle reached 1.53. The ratio of all tests to the human population reached 30.15. The ratio itself and in particular its relation to the size of the investigated populations represented at that time a historical record of international diagnostic and control actions against several dangerous zoonoses covering the whole territory of a developing country. From 5 046 070 allergic tests on glanders in horses 241 157 were positive, i.e. 4.39%; out of 332 684 allergic tests on glanders in camels 380 were positive, i.e. 0.12%; from 126 960 serological tests (complement fixation) on glanders in horses 24 760 were positive, i.e. 19.50%. From all 28 743 006 tests (agglutination, CFT) on brucellosis 660 432 were positive, i.e. 2.30%; from 432 919 tests in camels 9 987 were positive, i.e. 2.31%; from 2 892 658 tests in cattle 192 601 were positive, i.e. 6.66%; from 19 533 637 tests in sheep 320 709 were positive, i.e. 1.64%; from 5 834 450 tests in goats 136 222 were positive, i.e. 2.33%. In cattle positive reactions were caused by Brucella abortus and in sheep and goats by Brucella melitensis. Summary data on all 3 408 875 tuberculosis screening results (e.g., 3 113 115 in cattle) were not available to the author with the exception of Czechoslovak expeditions’ results in two provinces: from 677 402 PPD tuberculin tests in cattle 427 were positive, i.e. 0.06%. The programme represents an example of the successful transfer of international scientific knowledge (theoretical and applied research results) into territorial animal health population practice.

Introduction

On 30 May 1964 the author of this paper, heading at that time the Czechoslovak veterinary expedition against foot-and-mouth disease (FMD) in Mongolia was asked by Dr Baldziniam, the Mongolian Minister of Agriculture, who was cognizant of the successful Czechoslovak eradication programme against bovine brucellosis and tuberculosis (under professional responsibility of the author as National Chief Epizootiologist), to prepare an analogue programme for future international assistance against animal brucellosis, tuberculosis and glanders. At that time these diseases were causing big losses in livestock husbandry and production of food of animal origin in Mongolia and were even resulting in human fatalities. The minister was informed that this type of action was possible only after the eradication of
foot-and-mouth disease in the whole country which was achieved by the end of 1964, mainly thanks to successful anti-FMD activities of the Czechoslovak veterinary expedition applying modern methods (e.g., replacing the aphtization) including its effective imported vaccine. (For more information see Kouba (2006)).

The writing of this paper has been made possible only thanks to the statistical data provided on 14 January 2010 by Prof. Dr Zayat Batzukh, Director, Veterinary Institute, Mongolian State Agriculture University, Ulaanbaatar who was able to locate them in the Mongolian State Archive in Ulaanbaatar. Almost half a century after the end of the programme, it can be presented only as a historical report based on available incomplete statistical data, protocols of international meetings (Anonym, 1965), duty travel reports (Kouba, 1964, 1965), some publications (Kouba, 1964; Černovský and Ševčík, 1965; Jeřábek, Ládr and Boháč, 1969) and on the personal information of some surviving participants in the programme (Sugaaradza, 2007; Rothbauer, 2007, Jurák, 2008 and Rademacher, 2010). The provided statistical data deal with numbers at the national level only and do not take into account differences among individual provinces or expeditions.

Preparation of the project document

A working group of international specialists was created under the leadership of the author who was assisted by Prof. Dr Yarympyl and Dr Celendash (Mongolia), Prof. Dr Tsentsev (Bulgaria) and Prof. Dr Karpishov (Soviet Union). The official national counterpart was Dr Ts. Sugaaradza, Mongolian Chief Veterinary Officer who assisted in ensuring the suggested project document fitted with the local Mongolian conditions.

The main proposed project objectives were as follows:

- improved animal and human population specific health related to animal brucellosis, tuberculosis and glanders through a reduction in their focality and morbidity throughout the whole country;
- improved protection of animal and human populations (nomadic herders, consumers) against animal brucellosis, tuberculosis and glanders throughout the country;
- reduced losses in animal production and reproduction due to brucellosis, tuberculosis and glanders throughout Mongolia;
- improved production of meat and other products of animal origin in terms of quality (sanitary innocuousness) and quantity throughout the country.

Additional proposed project objectives consisted in:

- improving the standard of living of nomadic herder families through increased income thanks to better animal production;
- facilitating the increased export of Mongolian animal products;
- creating a solid starting basis for further control of animal brucellosis, tuberculosis and glanders at local, somon (district), aimak (province) and national levels;
- training Mongolian counterpart staff.

Among the expected positive outcomes were included also social factors relating to the contacts of the expeditions with the local nomadic herders (very often illiterates and living in great poverty), even in very remote territories, with the culture of more advanced countries brought by the foreign specialists working with them and for them.
Method

At that time there was an accepted Czechoslovak epizootiological strategy, and principles and methods based on the available basic and applied research results and rich successful practical experience at national level. These consisted in:

identifying specific disease occurrence in the whole country through discovering all affected herds (including the identification of the grade of infection occurrence - prevalence, localization and movement routes - including mapping, size, structure, breeding and environmental conditions, etc.) using mass screening of all ranches of susceptible animals species in all provinces;

An All-country infection control programme cannot be based only on absolutely incomplete ad hoc passive reporting which cannot be sufficient in uncovering the full epizootiological reality (i.e. all affected herds-outbreaks) and for effective control/eradication programmes.

- applying a complex of diagnostic methods (serological, allergic, clinical and epizootiological) using international standards (WHO/FAO) for diagnostic method procedures and for the uniform interpretation of results: for glanders investigation to use allergic tests and the complement fixation test, for brucellosis investigation to use the serum agglutination test and complement fixation test and for tuberculosis investigation to use an allergic test with PPD tuberculin;

At that time Mongolian cattle, sheep, goat and camel populations were not yet vaccinated against brucellosis.

- to try, where and when possible, to mark visibly and permanently positive animals (e.g. triangle holes in left auricles in case of tuberculosis and in right auricles in case of brucellosis), to isolate them without following retesting and to cull them as soon as possible (special attention to be given to them at slaughter);

- to identify and recommend measures and necessary conditions for specific health protection of country people and consumers as well as of non-positive herds and animals, always considering the local environment;

- to create a professional and practical basis for future national programmes against these diseases in Mongolia as a follow-up to the activities and results of international veterinary expeditions.

As managerial measures it was necessary:

- to introduce a particular legislation supporting the programme;
- to introduce a specific information system for collecting relevant data on the mass screening (including specific forms/questionnaires for data collection and processing) and databases for the decision making of Mongolian central, aimaks and somon veterinary authorities exploiting gained knowledge of epizootiological situation in terms of focality and morbidity of selected zoonoses;
- to develop an intensive publicity campaign targeted at rural populations to convince them about the need of the programmes and to support it;
- to introduce a practical centralized planning system of vertical management of the programme, including concrete objectives (in time and place) and responsibilities as well as periodic evaluations (used for necessary amendments and adjustments of the programme);
- to identify the priorities to achieve the objectives as best as possible.
Fig. 1. Territory of Mongolia subdivided according to individual aimaks (provinces) representing the limits of action for individual international veterinary expeditions

The project was tailored to cover all 16 Mongolian aimaks and country populations of horses (reported 2,250,000), camels (reported 630,000), cattle (reported 2,030,000), sheep (reported 12,800,000) and goats (reported 4,270,000). The total reported number of all animals included in the programme reached 21,980,000 (average number of selected species animals per km² = 14.04).

The first proposals against brucellosis were finished on 4 June, against tuberculosis on 8 June and against glanders on 16 June 1964.

Field pilot testing.

The suggested disease investigation and control methodology was initially tested in field practice by the author accompanied by a Mongolian epizootiologist: in Zuulacharaa State farm, Bajangol Cooperative, Darchan State Farm and Darchan Cooperative.

Further testing of the proposed methodology was carried out by a present Czechoslovak veterinary expedition against foot-and-mouth disease in Mongolia after it finished its main task – eradication of this disease. This phase of proposed methodology testing was supported by a mobile veterinary diagnostic laboratory imported by the expedition. During three weeks there 2,081 animals were investigated for brucellosis in Bajan-agt and Bulgan aimak using a serological test and 631 animals using F-allergen, 993 animals for tuberculosis using PPD tuberculin, 30 horses for glanders using a serological test and 46 horses using an
allergy test as well as 34 camels using an allergy test. Particular attention was given to comparative study of different forms of practical temporary identification (marking, registration) of investigated animals. For more information see Kouba (2009).

**International clearance of the multilateral project**

The draft of the multinational project to help solving specific veterinary problems in Mongolia was sent to all participating country governments for study and comments. Dr Baldziniam, Mongolian Minister of Agriculture (referring to CMEA agriculture ministers’ recommendation to provide proposed veterinary help to Mongolia on a bilateral voluntary basis) organized a special international scientific-methodological conference to finalize the project document. The conference, held in Ulaanbaatar, 4-12 March 1965, was attended by national specialists (epizootiologists and diagnosticians) from Bulgaria, Czechoslovakia, the German Democratic Republic, Hungary, Poland, Soviet Union and Mongolia as the host country. Czechoslovakia was represented by the author (Vice-Director and Chief Epizootiologist, State Veterinary Service) who together with Dr Sugaaradza, Mongolian Chief Veterinary Officer presented and defended the original project proposal. This was adjusted according to the comments of other participating countries. The conference objective was to finalize the diagnostic methods and procedures of specific disease control. Simultaneously, there were elaborated activity norms, lists of necessary equipment for international anti-zoonotic expeditions as well as the principles for their performance and management.

Special excursions to assess the project realization under the conditions of the Mongolian desert, steppe and mountains were organized for the conference participants. The feasibility of the proposals were discussed for different environments such as ranches, farms and brigades.

Fig. 2.
International scientific-methodological conference held in Ulaanbaatar, 4-12 March 1965, to finalize the project document for international expeditions against brucellosis, tuberculosis and glanders in Mongolia
Results of the scientific-methodological conference

In order to properly prepare the multinational anti-zoonotic assistance, it was recommended not to start before 1966. Meanwhile during 1965, starting in May, experimental groups composed from specialists of participating countries (if possible, the specialists selected to be future leaders of national expeditions) ascertained the basic practical needs and conditions of the project in the assigned aimaks which helped to prepare better future national expeditions. The experience of the previous Czechoslovak expedition against foot-and-mouth disease during six months in 1964 proved to be very useful for the preparation of the programme.

Analysing the tasks it was recommended to increase the number of specialists and assisting staff. Due to harsh conditions which did not allow effective work throughout the whole year it was necessary to limit the annual working period of expeditions to six months from April to September during 1966, 1967 and 1968. The period was left flexible because of the very different climatic conditions among individual aimaks. It was suggested that the expeditions work simultaneously in all aimaks covering all Mongolian territory.

In the final protocol there were included also recommended norms of material needs. Transport means, such as personal off-road cars and trucks, were recommended to be assured for the expeditions by the Soviet Union as well as the diagnostic preparations to guarantee comparative results and their uniform interpretation. This country was that time the only one able to provide transport means and the required bio-preparations in the necessary quantity.

The project provisional proposals calculated with 108 anti-zoonotic units/groups each composed of 15 persons, including two veterinarians and two laboratory technicians from any participating country while the remainder were Mongolian staff.

The preparatory activities of all international veterinary expeditions were very demanding. It was necessary to assure funds for the expedition staff (travel expenses, salary at home, “pocket” money, etc.), material and operating costs. It was necessary to select veterinarian-volunteers having practical experience with animal tuberculosis and brucellosis diagnosis, epizootiology and measures, being in good health and having physical conditions capable of withstanding the harsh Mongolian conditions and if possible to have driving licence. Among the material supplies belonged laboratory diagnosis facilities (when possible mobile diagnostic laboratories) and equipment, different means of transport, human (gammaglobulin was of particular importance) and veterinary medicaments, etc. The provision of sufficient repellents against mosquitoes and other insects was recommended, as well as antisera against Mongolian venomous snakes (e.g. gjurza in dry areas, effa in humid area; that time specific antisera were not available in Central Europe; they were obtained from Russian Serum Institute in Omsk), etc..

The expedition members had to pass preventive vaccinations according to relevant particular expedition territory risks (e.g. against typhus abdominalis, viral hepatitis A and B, poliomyelitis, tetanus, meningococcal meningitis, diptheria, plague - Yersinia pestis).

The overall task was to ensure that expeditions be fully prepared and equipped to work as relatively independent units minimizing the requirements for Mongolian institutions.
Example: Czechoslovak diagnostic/control actions were carried out in Bulgan and Uvurchangaj aimaks. For this purpose transport means, equipments, materials, a mobile diagnostic laboratory, etc. were appropriated from the previous 1964 expedition against foot-and-mouth disease. The newly expanded activities required that the following Czechoslovak expeditions be equipped additionally with eight new personal off-road cars, one truck, seven electro generators including spare parts, many different materials for the expedition member professional activities (laboratory equipment, biological preparations) and for surviving under the harsh Mongolian conditions. All additional material was sent well in advance by train.

The overwhelming responsibility for the expedition preparation, for its transfer, adequate living and working conditions, personal safety, for material as well as for assigned money spending lay with the leaders of individual expeditions being dependent on Mongolian institutions and staff support.

**Environmental conditions**

In the 1960s Mongolia with 1 564 116 km$^2$ (as vast as the whole of Western Europe) was the most sparsely populated country in the world, with a population of around 1 249 000 people (average number of persons per km$^2$= 0.79). The country contained very little arable land, as much of its area was covered by steppes, with mountains to the north and west and the Gobi Desert to the south. Approximately 80% of the population was nomadic or semi-nomadic.

Mongolia has harsh climatic conditions with an extreme continental climate with long cold winters and short summers, during which most of its annual precipitation falls. Most of the country is hot in the summer (in the Gobi up to 50 °C) and extremely cold in the winter, dropping as low as -40 °C.

An example of temperature differences between daily heats and night frosts: on 24 April 1964 in anti-FMD vaccination starting day in Erdene Somon, in the Gobi desert at the Chinese border the midday temperature reached 45 °C (many from the Czechoslovak expedition members suffered by second degree burns – vesicles on auricle tips) and in the night – 8 °C requiring particular protection of the FMD vaccine against freezing).

**Living conditions**

Living conditions for the expeditions in individual aimaks were very different. Usually, there were many difficulties with transfer, accommodation, catering, foodstuff and drinking water provisions. Therefore individual expeditions tried to be equipped as best as possible, knowing that in this extremely poor and very large country the possibilities were very limited, especially in remote localities, which lacked almost everything. The participating expeditions tried to import as much as possible so as to be self-sufficient; i.e., to act as units relatively independent of the Mongolian authorities, facilities and provisions.

The expeditions used different field camps with tents or Mongolian yurts when required to work outside and overnight. Usually they used sleeping bags and rubber air mattresses. When located in or making stopovers in aimak or somon centres, the expedition staff could be accommodated in local dormitories.

The expeditions tried to import with them all material necessary for their staff catering and to be as independent as possible from Mongolian provisions. Among these materials belonged the field "kitchen" with dishes and non-perishable foodstuffs - canned food, dehydrated food such as vegetables, potatoes, etc. The expeditions exploited the limited possibilities of replenishing their food supplies by purchasing local foodstuff, e.g. meat and milk products, vegetables, etc. The expeditions also brought hunting and fishing equipment to allow the
hunting and capture of fresh meat and fish (antelopes, bustards, partridges, fish etc.). Sometimes the expeditions were given sheep or other food animals by the local authorities.

In the Gobi there were serious difficulties in getting drinking water. A lack of fresh vitamins was partially replaced by using the Gobi desert wild onion available in some localities.

Due to the harsh and widely varying climatic conditions the expeditions also imported necessary clothing and footwear not only for “normal” temperatures but also for all possible conditions including hot, wet, and frosty conditions. All members of the expeditions brought with them necessary tools for personal hygiene.

The expeditions imported also many medicaments, sanitary facilities (including first-aid boxes – injury was not rare), cleansing and disinfection means, maintenance materials (including spare parts), binoculars, compasses, signal materials for day and night (at that time suitable radio-communication devices were not available), etc.

At that time in the majority of remote somons there were not any medical doctors. Some expeditions brought with them their own medical doctor.

Mongolian colleagues also provided storage facilities and the guarding of expedition material. For each of the expeditions there were prepared guarded store rooms in somon or aimak centres.

**Working conditions**

A key component of any international expedition are veterinary diagnostic laboratory facilities with complex equipments, e.g. for sterilization and refrigeration, glassware and ingredients for serologic investigation of animal brucellosis and glanders, etc. Simultaneously, there were imported different instruments for specimen collection, transport and laboratory processing as well as tools for allergy testing for tuberculosis and glanders. For this purpose there were imported mobile diagnostic laboratories or at least the full equipment of a diagnostic laboratory exploiting local facilities such as aimak veterinary laboratories, if any, or suitable rooms to be converted into a temporary laboratory. Imported electric generators were very important for the expeditions’ work and meant that they were not dependent on unreliable local electric sources, if any (electricity in Mongolia was at that time available in only a very few major cities, not in rural areas).

Fig. 3

Czechoslovak mobile veterinary diagnostic laboratory with electric generator in Bulgan aimak steppe, 1966
The expeditions were supplemented by supporting Mongolian veterinarians, drivers and interpreters together with some off-road cars. The Mongolian support staff provided fuel, yurts, maps (there was a lack of standard maps for orientation; some expeditions had only a big school map of Mongolia without any details) as well as assistance in finding dispersed free-moving herds (without fences or housing), which were almost always on the move and in the catching, fixing and temporary marking of the animals.

Among the obstacles was a lack of suitable roads, if any were to be found at all, high mountains, snow and in spring in the northern part of the country often river floods (which could prevent cars from crossing the watercourse). The programme was further complicated by the very great distances between herds and the lack of standard roads also caused difficulties with orientation in the large territories, particularly in very remote desert or steppe regions, where losing the way did occur.

Being without any radio-communication tools the expeditions were often isolated from the surrounding world and the investigating groups were often isolated as well. Missing radio-communication created managerial problems when organizing the investigation and during expedition transfer to new localities. The isolation was compounded by an absence of normal telephone connections in many somon centres and by an almost completely missing postal service.

Finding, concentrating, and the catching and fixing of dispersed semi-wild free-grazing animals (in large plain deserts and steppes there were no trees) presented extraordinary difficulties. A particular challenge was linked with animal evidence and the marking of investigated animals so as to distinguish them from those not yet tested in the same herd (separation was often impossible) and to find animals discovered to be serologically positive. Car service facilities were usually absent and maintenance and repairs were carried out as provisional “Do-It-Yourself” by the expeditions themselves. There were serious problems in getting necessary spare parts.

Another problem was the officially reported numbers of animals to be investigated which were often greatly lower that the actual numbers. The expedition members were taken daily to indicated herds by off-road vehicles. Work planning depended mainly on organizational arrangement carried out by local authorities. Time losses were caused by long transfers to distant localities or due to difficulties in the activity organization.

At that time Mongolia had only one railway line running from the Soviet to Chinese borders and which functioned only from the north to the capital Ulaanbaatar, while the rest was out of order – under Gobi sand.

Realization of the project by international expeditions

Czechoslovak anti-epizootic expeditions commenced in advance in 1965 under the leadership of Dr Evžen Jurák who had participated in the anti-FMD expedition one year before.

The programme implementation started in full in the spring of 1966 in all aimaks as had been planned and finished by the end of 1968. All 16 aimaks were divided among individual country expeditions to cover all Mongolian territory: Bulgaria – one, Hungary – two, Germany – one, Poland – two, Czechoslovakia – two and Soviet Union - eight (see Table I.).

The number of international expedition members reached 149 veterinarians in 1966, 122 laboratory technicians/animal health assistants, 26 technical employers and drivers, a total
number of 297 persons. In 1967 the number of veterinarians reached 170, together with 71 laboratory technicians/animal health assistants, 15 technical employers and drivers, giving a total of all together 256 persons. In 1968 the numbers were 172 veterinarians, 67 laboratory technicians/animal health assistants, 10 technical employers and drivers, all together 249 persons. Summary numbers during the programme duration 1966-1968: 491 veterinarians, 260 laboratory technicians/animal health assistants, 51 technical employers and drivers, all together 802 persons (not considering that many of them participated in more than one year). For more information see Table II.

Simultaneously, two Czechoslovak specialists for human and animal brucellosis under the World Health Organization project were working in Mongolia: MUDr Zdeněk Ježek (later the leading specialist in the WHO’s successful programme to eradicate human small pox worldwide) and MVDr Jan Kolář (discoverer of the F-allergen for brucellosis diagnosis).

In summary during the three year programme the expeditions were divided into 16 teams with 74 working groups being provided with 73 trucks and 189 off-road cars as well as 92 diagnostic laboratory facilities (including mobile laboratories with electro generators). For more detail see Table III.

Each expedition was given an annual goal in the form of the planned number of animals to be tested and where.

The expeditions as well as their Mongolian colleagues also had to grapple with an enormous number of expected and unexpected problems.

**Size of the investigations**

The plan for glanders allergic tests which proposed the testing of 4 208 947 horses and 170 005 camels was exceeded by 20% and almost 100%, respectively. That is, 5 046 070 horses were tested and 332 684 camels. An additional 126 960 horses were investigated serologically using the complement fixation test. The plan for brucellosis serological tests proposing 28 265 551 tested animals was exceeded with 28 743 006, i.e. 101.69% of the target (e.g. 432 919 in camels, 2 892 658 in cattle, 19 533 637 in sheep and 5 834 450 in goats). The plan for tuberculosis allergic (PPD tuberculin) tests proposed 3 433 067 while in reality 3 408 875 animals were tested, i.e. 99.30% of the target (e.g. 3 113 115 in cattle).

In the whole country the reported number of specific tests reached 37 657 595.

Czechoslovak expeditions contributed (without considering 1964-1965 pilot investigations) a total of 3,887,885 specific tests.

The relative size of the investigations of selected zoonotic diseases carried out by international expeditions in Mongolia during 1966-1968 can be expressed using a particular epizootiological indicator – ratio of the number of tests to the total official number of animals of selected species (I/P) in the whole country (see Tab. IV).

Due to particular difficulties (e.g. free grazing and nomadic moving) it was often impossible to identify and notify individually all tested animals, mainly when searching serologically positive ones for marking, isolation or priority culling.

The ratio of allergic tests on glanders in horses to their population reached 2.43. This same ratio for serological tests reached 0.06. The ratio allergic + serological test together on glanders in horses relative to their population was 2.48. The ratio of allergic tests on glanders in camels relative to their population reached 0.53.
The ratio of serological tests for brucellosis in camels relative to their population reached 0.69. The same ratio for serological tests in cattle was 1.42. The ratio of serological tests for brucellosis in sheep relative to their population reached 1.53, while this same ratio for goats was 1.37.

The ratio of allergic tests for tuberculosis in cattle relative to their population reached 1.53.

The ratio of all tests on selected zoonoses of all selected animal species to their population reached 1.73.

The ratio of all tests of animals on selected zoonoses to the human population was equal to 30.15 (37 657 595 / 1 249 000).

The national average number of selected species animals was at that time 14.04 per km². The average number of specific tests carried out by international veterinary expeditions reached 24.06 per km².

**Results of the investigations**

From the allergic tests on glanders in horses 241 157 were positive, i.e. 4.39%. From the allergic tests on glanders in camels 380 were positive, i.e. 0.12%. From the complement fixation tests on glanders in horses 24 760 were positive, i.e. 19.50%.

From the serological tests on brucellosis in all animals of selected species 660 432 were positive, i.e. 2.30%; in camels 9 987 were positive, i.e. 2.31%; in cattle 192 601 were positive, i.e. 6.66%; in sheep 320 709 were positive, i.e. 1.64%; in goats 136 222 were positive, i.e. 2.33%. In cattle positive reactions were caused by *Brucella abortus* and in sheep and goats by *Brucella melitensis*.

Summary data on all tuberculosis screening results were not available to the author. Only partial data from the Bulgan and Uvurkhangai aimaks can be reported where from 677 402 PPD tuberculin tests in cattle carried out by Czechoslovak expeditions 427 were positive, i.e. 0.06%.

A meeting of the Chief Veterinary Officers of all participating countries was held in Ulaanbaatar, October 1968 to evaluate the international anti-epizootic assistance which had been provided to Mongolia.

**Discussion and conclusion**

Due to the fact that no information on a similarly large and complex anti-zoonotic programme was found in the scientific literature, the author has not carried out any comparative study.

The international programme and methods initially elaborated by the above mentioned working group of specialists, and adjusted according to the comments of the specialists from participating countries as well of Mongolian veterinarians (headed by Dr Ts. Sugaaradza), proved to be feasible and useful. While the objectives were clear-cut, however, their achievement was extraordinary complicated and difficult.

In all 16 Mongolian aimaks over three years long-term international expeditions from five countries were actively working. Together with hundreds of foreign veterinary experts – epizootiologists and diagnosticians – there were working hundreds of Mongolian veterinarians and thousands of Mongolian supporting staff with the active assistance of local countrymen as well as of somon, aimak and central authorities. All of them must be highly commended for the work done, particularly when considering the difficulties they had to overcome: the harsh Mongolian climate, poor logistics, and lack of standard roads, problems...
with accommodation, catering, medical service and the challenges associated with the transport of so many persons. Other serious difficulties were represented by the catching and fixing of free moving animals for testing and the marking of positive animals. The staff of the expeditions, usually working in very bad hygienic conditions, was continuously exposed to many local infectious and parasitic diseases transmissible from animals.

An almost incredible preparatory and managerial work was achieved by the Mongolian authorities to assure bilateral international agreements with all participating countries; necessary funds for national staff, material and activities; legislation and specific instructions (in Mongolian and Russian); staff to assist international expeditions (interpreting, catching and fixing animals); transport, accommodation and catering, related facilities, communication, medical care; maintenance and repair of transport means and diagnostic tools; administrative work such as special information systems - statistics, etc.; identification of realistic objectives and tasks for each expedition, their supervision; vertical and horizontal coordination and planning; intensive instructive training courses for national staff; the implementation of a convincing nation-wide information campaign; other supporting staff at all levels, mainly of local herders and of administrative institutions; etc. Extremely demanding work was carried out also during the whole programme to solve the almost infinite operational problems.

The Mongolian veterinary service was at that time relatively well staffed and organized and enjoyed a respected social position from the somons up to government. Many cooperatives and state ranches as well as somons, aimaks, several ministries (including of agriculture), academy of science, agriculture university, etc. were headed by veterinarians with key professional positions thanks to the decisive importance of livestock (up to 80%) for the national economy. In no other country has the veterinary service wielded such a high authority as in Mongolia at that time. This fact facilitated the realization of the above mentioned programme.

The veterinary expeditions, after finishing their work and before leaving the country in 1968, left (free of charge) almost all imported material (to a value of many tens of millions of Mongolian tugriks = many millions of US dollars) to the Mongolian veterinary service to use for follow-up national anti-zoonotic programmes.

According to available data the expeditions during 1966-1968 carried out the following numbers of specific investigations: on glanders – 5 505 714, for brucellosis – 28 743 006, and for tuberculosis – 3 408 875. For a concise summary see Table V. The follow-up consisted in the marking of positive animals, their isolation and premature culling simultaneously with recommended measures for outbreak elimination and for the protection of local personal and of healthy herds.

The paper has dealt with the number of tests and not with the number of investigated animals due to the fact that some animals were tested more than once (retesting of previous-year negative animals). The reproduction process (herd turnover) influenced the number of tested animals at a particular moment; e.g. many tested animals had been eliminated by culling, normal or as positive reactors and many others by natural death due to diseases or extreme winter frost and hunger.

In the whole of Mongolia the reported number of specific tests reached 37 657 595. This number itself and in particular its relation to the investigated populations represented at that time a historical record of international diagnostic and control actions against several very dangerous diseases transmissible to man covering the whole territory of a developing country.
The original programme and methods of international multi-disease investigations and control of major zoonoses in animal populations applied in an enormous country simultaneously by the expeditions of several countries is probably without parallel in the history of veterinary medicine. It was also a source of great pride and satisfaction to Czechoslovak action-oriented “epizootiology school” as the main professional initiator and “motor”.

Every expedition together with their members could describe a different experience with particular living and working conditions as well as with different results during the programme. All of them merit high appreciation for exemplary work done. The Mongolian supporting staffs merit similar appreciation.

The obtained results had a multiplying effect thanks to the application of the programme at a country-wide level with long-term impact on the development of animal husbandry, production of meat and other products of animal origin as well as on the health of nomadic herders and city consumers throughout all Mongolia. Thanks to the effective help of all participating international veterinary expeditions, many tens of thousands of Mongolian countrymen and consumers were protected from illness, disability or death due to the mentioned very dangerous zoonoses. The results provided a basis and experience for further specific zoonose control actions carried out by the national veterinary service and other relevant institutions of Mongolia.

The programme represented an example of the successful transfer of international scientific knowledge (theoretical and action-oriented applied research results) in epizootiology into territorial animal health population practice.

The gained experience could be useful for future solutions to similar animal population health problems. For more information see Kouba (2010).

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Annexes

Table 1
Mongolian aimaks (provinces) assigned to international veterinary anti-zoonotic expeditions according to individual countries

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<tr>
<th>Country</th>
<th>Aimak (province)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>Dornod</td>
</tr>
<tr>
<td>Hungary</td>
<td>Khetii, Dornogobi</td>
</tr>
<tr>
<td>Germany</td>
<td>Selenge</td>
</tr>
<tr>
<td>Poland</td>
<td>Tuv and Dundgobi</td>
</tr>
<tr>
<td>USSR</td>
<td>Arkhangai, Bayanulgii, Bayankhongor, Gobialtai, Zavkhan, Khovd, Uvs, Kuvsgul</td>
</tr>
<tr>
<td>Czechoslovakia</td>
<td>Bulgan, Uvurkhangai</td>
</tr>
</tbody>
</table>

Table 2
Summary statistical data covering all Mongolian territory on the number of international anti-zoonotic expedition staff by country during 1966-1968

<table>
<thead>
<tr>
<th></th>
<th>Veterinarians</th>
<th>Laboratory technicians and animal health assistants</th>
<th>Technical employers and drivers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>10</td>
<td>10</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Hungary</td>
<td>6</td>
<td>11</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>Germany</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Poland</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>24</td>
</tr>
<tr>
<td>USSR</td>
<td>97</td>
<td>97</td>
<td>99</td>
<td>86</td>
</tr>
<tr>
<td>Czechoslovakia</td>
<td>6</td>
<td>22</td>
<td>23</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>170</td>
<td>172</td>
<td>122</td>
</tr>
</tbody>
</table>

From 1966 to 1968

Veterinarians 491
Laboratory technicians and animal health assistants 260
Technical employers and drivers 51
Total 802
Table 3
Summary statistical data covering all Mongolian territory on the number of international teams, groups, cars and laboratories taking part in the anti-zoonotic programme during 1966-1968

<table>
<thead>
<tr>
<th>Countries</th>
<th>Number of teams</th>
<th>Number of groups</th>
<th>Cars</th>
<th>Laboratory facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Trucks</td>
<td>Off-roaders</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Hungary</td>
<td>2</td>
<td>9</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>Germany</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Poland</td>
<td>2</td>
<td>12</td>
<td>-</td>
<td>38</td>
</tr>
<tr>
<td>USSR</td>
<td>8</td>
<td>43</td>
<td>55</td>
<td>112</td>
</tr>
<tr>
<td>Czechoslovakia</td>
<td>2</td>
<td>7</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>74</td>
<td>73</td>
<td>189</td>
</tr>
</tbody>
</table>

Table 4
Relative size of all investigations of zoonotic diseases carried out by international expeditions in Mongolia during 1966-1968 – ratios investigations/populations (I/P)

<table>
<thead>
<tr>
<th>Disease</th>
<th>Method</th>
<th>Investigations</th>
<th>Population</th>
<th>Ratio I/P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glanders</td>
<td>Allergic</td>
<td>5 460 070</td>
<td>2 250 000</td>
<td>2.43</td>
</tr>
<tr>
<td></td>
<td>Serological</td>
<td>126 960</td>
<td>2 250 000</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>Allerg+serol.</td>
<td>5 587 030</td>
<td>2 250 000</td>
<td>2.48</td>
</tr>
<tr>
<td>Brucellosis</td>
<td>Serological</td>
<td>332 684</td>
<td>630 000</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td>Serological</td>
<td>432 919</td>
<td>630 000</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>Serological</td>
<td>2 892 658</td>
<td>2 030 000</td>
<td>1.42</td>
</tr>
<tr>
<td></td>
<td>Serological</td>
<td>19 533 637</td>
<td>12 800 000</td>
<td>1.53</td>
</tr>
<tr>
<td></td>
<td>Serological</td>
<td>5 834 450</td>
<td>4 270 000</td>
<td>1.37</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>Allergic</td>
<td>3 113 115</td>
<td>2 030 000</td>
<td>1.53</td>
</tr>
<tr>
<td>All investigations</td>
<td></td>
<td>37 657 595</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All selected species</td>
<td></td>
<td>21 980 000</td>
<td>1.71</td>
<td></td>
</tr>
<tr>
<td>Human population</td>
<td></td>
<td>1 249 000</td>
<td>30.15</td>
<td></td>
</tr>
</tbody>
</table>
### Table 5
Summary table on the results of zoonotic disease investigations carried out by international expeditions in Mongolia during 1966-1968

<table>
<thead>
<tr>
<th>Disease</th>
<th>Method</th>
<th>Investigations</th>
<th>Positive results</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glanders</td>
<td>Total</td>
<td>5,505,714</td>
<td>241,537</td>
<td>4.39</td>
</tr>
<tr>
<td></td>
<td>Allergic Horses</td>
<td>5,046,070</td>
<td>241,157</td>
<td>4.78</td>
</tr>
<tr>
<td></td>
<td>Allergic Camels</td>
<td>332,684</td>
<td>380</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>serological Horses</td>
<td>126,960</td>
<td>24,760</td>
<td>19.50</td>
</tr>
<tr>
<td>Brucellosis</td>
<td>serological Total</td>
<td>28,743,006</td>
<td>660,432</td>
<td>2.30</td>
</tr>
<tr>
<td></td>
<td>e.g. Camels</td>
<td>432,919</td>
<td>9,987</td>
<td>2.31</td>
</tr>
<tr>
<td></td>
<td>e.g. Cattle</td>
<td>2,892,658</td>
<td>192,601</td>
<td>6.66</td>
</tr>
<tr>
<td></td>
<td>e.g. Sheep</td>
<td>19,533,637</td>
<td>320,709</td>
<td>1.64</td>
</tr>
<tr>
<td></td>
<td>e.g. Goats</td>
<td>5,834,450</td>
<td>136,222</td>
<td>2.33</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>Allergic Total</td>
<td>3,408,875</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td>e.g. Cattle</td>
<td>3,113,115</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td>37,657,595</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>