

INCIDENCE OF ANTIBODIES TO VARIOUS SEROVARS  
OF LEPTOSPIRA INTERROGANS IN POLICE DOGS

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A group of police dogs (German sheep-dogs) were examined serologically for leptospiral antibodies in the South Bohemian Region on two occasions in 1984. A total of 298 dogs were examined in winter and 313 animals in summer. The examination revealed antibodies to various serovars of *Leptospira interrogans* in 56.71 % of the dogs in winter and in 69.01 % of the animals in summer. On the whole, leptospiral antibodies to 9 serovars were demonstrated, the most frequent among them being those to serovars grippotyphosa and icterohaemorrhagiae (copenhageni) and to leptospirae of group Sejroe.

The increased proportion of dogs with leptospiral antibodies in summer, particularly with those to serovars grippotyphosa and icterohaemorrhagiae (copenhageni) is accounted for by more frequent contact of the dogs with animal reservoirs of these leptospirae, i.e. with field-mice (*Microtus arvalis*) and brown rats (*Rattus norvegicus*) whose populations are highest in summer or possibly autumn.

Differences in the incidence of leptospiral antibodies in the dogs were found in dependence upon the biocoenosis in which the individual posts were situated. The main factors involved in the incidence of leptospiral antibodies in dogs are the season and the mode in which dogs move in a given environment.

Antibodies, Leptospirae, biotopes, dogs.

Leptospirosis is an infectious disease common to wild, domestic and farm animals as well as to man. This zoonosis is characterized by a marked incidence of natural outbreaks. The causative agent, *Leptospira interrogans* (further referred to as L.i.), is antigenically heterogenous and gives rise to a number of se-

rological variants - serovars. Šebek and Rosický (1974), summarizing the results of examination conducted in Czechoslovakia, reported the incidence of 13 serovars of leptospirae of 10 serological groups.

The dog was the first animal species in which the clinical picture of leptispirosis was described as "canine typhus" as early as 1852. In 1923 professor Lukeš, in his study on an epizootic of canine typhus, demonstrated that the disease was caused by the spirochaetes - leptospirae. Further research showed that the dog is susceptible not only to serovars canicola and icterohaemorrhagiae but also to a number of other serovars of leptospirae. Particularly police dogs, hounds and sheep-dogs are daily in a natural environment, i.e. in an environment with potential foci of leptispirosis. In the present study a large sample of police dogs were subjected to serological examination six months apart (winter and summer 1984) with the objective to find whether the incidence of L.i. antibodies would vary from one post of police dogs to another and whether it would be affected by the season in which blood samples were collected.

#### Material and Methods

The animals examined were police dogs kept in the South Bohemian Region in the area between the pass of Vyšší Brod and the borderline dividing the South Bohemian Region from the South Moravian Region. Geographically, this area includes the massif of the Novohradské Mountains, the river-basin of the Lužnice and the south-west part of the Bohemian-Moravian Uplands.

The Novohradské Mountains are characterized by long-standing snow cover and severe frosts in winter and high rainfall in summer. The area is, on average, about 700 m above sea level and is wooded mainly with the spruce. Dogs were examined there at 7 posts.

The Lužnice river-basin is flat with sand subsoil and is about 500 m above sea level. Climatically, it is milder than the Novohradské Mountains. It is wooded mainly with the pine. In this area, too, dogs were examined at 7 posts.

The south-west part of the Bohemian-Moravian Uplands is a very cold area, sometimes referred to as "Bohemian Canada" and is about 650 m above sea level. About 50 % of the area is wooded with either the spruce or the pine. Dogs in this area were also examined at 7 posts.

The aforementioned biotopes favour the incidence and survival of various species of small terrestrial mammals which are found there in large numbers.

All the dogs examined for antibodies to L.i. were German sheep-dogs. They were housed in standard concrete-floored metal pens and fed heat-treated food. They were daily in the field.

A total of 298 dogs were examined in January-February 1984 and the same animals plus 15 new arrivals, thus totalling 313 dogs, were examined in July-August 1984. Blood samples were withdrawn from the vena cephalica antebrachii after its compression. The frozen sera were transported to the laboratory of the Department of Epizootiology and Microbiology of the University of Veterinary Science, Brno, where they were examined for leptospiral antibodies. The microagglutination-lysis test was carried out according to

a standard method (Šebek 1979). The following strains of leptospirae were used: /1/ *L. icterohaemorrhagiae* - Fryšava, /2/ *L. grippophytosa* - P 125, /3/ *L. sejroei* - M 84, /4/ *L. canicola* - Canis 7, /5/ *L. pomona* - Šimon, /6/ *L. bratislava* - Jež Bratislava, /7/ *L. arborea* - M 7, /8/ *L. bataviae* - Moldava, /9/ *L. bulgarica* - Nikolaevo, /10/ *L. sorex jalna* - Sorex Jalna, /11/ *L. jalna* - Jalna, /12/ *L. tarassovi* - S 42. The sera reacting in the basic dilution of 1:100 were diluted further in two-fold steps.

## Results

In the blood sera examined in January-February 1984 leptospiral antibodies were found in 56.71 % of the dogs. The largest proportion of the sera (77 sera, i.e. 45.56 %) reacted with leptospirae of serovar *grippophytosa*, 44 sera (26.04 %) with leptospirae of group *Sejroei* and 17 sera (10.06 %) reacted with leptospirae of serovar *icterohaemorrhagiae* (*copenhageni*). A survey of the incidence of antibodies to the individual serovars in the blood sera examined in January-February 1984 is shown in Table 1. Dogs of this group showed, on average, antibodies to 1.84 serovars of leptospirae. The sera reacted in a titre range of 100 to 12 800. Most reactions (61.5 %) were demonstrated in low titres (100 to 400) and only 38.5 % of the sera reacted in titres of 800 and higher.

In the blood sera examined in July-August 1984 leptospiral antibodies were found in 69.01 % of the dogs. The largest proportion of the sera (112 sera, i.e. 51.85 %) reacted with serovar *grippophytosa*, 43 sera (19.91 %) with leptospirae of group *Sejroei* and 22 sera (10.1 %) with leptospirae of serovar *icterohaemorrhagiae* (*copenhageni*). A survey of the incidence of antibodies to the individual serovars of leptospirae in the blood sera examined in July-August 1984 is shown in Table 2. Dogs of this group showed, on average, antibodies to 1.42 serovars. The sera reacted in a titre range of 100 to 12 800. Most reactions (70.3 %) were demonstrated in low titres (100 to 400) and only 29.3 % of the sera reacted in titres of 800 and higher.

Both examinations revealed antibodies to the same 9 serovars of leptospirae. Separate significant antibody titres, however, were demonstrated only to serovars *grippophytosa*, *icterohaemorrhagiae* (*copenhageni*), *bratislava* and to leptospirae of group *Sejroei*. Reactions with serovars *pomona*, *canicola*, *bulgarica*, *sorex jalna* and *arborea* were found only as coagglutination at concurrently higher titres with serovars *grippophytosa* and *icterohaemorrhagiae*.

The incidence of leptospiral antibodies found at 21 different posts of the three areas under study is shown in Fig. 1 and 2.

The highest incidence of leptospiral antibodies was found in dogs kept at posts 10 and 11 (69.0 % and 71.0 % respectively). The lowest incidence of leptospiral antibodies to various serovars was found in dogs at posts 17 and 19 (10.0 % and 5.0 % respectively). At 15 posts antibodies were demonstrated most frequently to serovar *grippophytosa*, the incidence of which was highest at posts 5 and 15 (75 % of the dogs with antibodies). At 4

Table 1

Survey of the incidence of antibodies to Leptospira interrogans (L.i.) in the sera of police dogs in January-February 1984

Serovar L.i.	1:100	1:200	1:400	1:800	1:1600	1:3200	1:6400	1:12800	total	%	$\bar{X}$ g
grippytophosa	10	9	9	18	16	10	4	1	77	45.56	1:314
sejroe	16	10	11	3	3	1	-	-	44	26.04	1:249
icterohaemorrhagiae	5	2	2	4	2	1	1	-	17	10.06	1:452
bratislava	2	1	4	-	-	1	-	-	8	4.73	1:336
bulgarica	4	4	-	-	-	-	-	-	8	4.73	1:141
sorex-jalna	3	3	-	-	-	-	-	-	6	3.55	1:141
pomona	2	4	-	-	-	-	-	-	6	3.55	1:159
canicola	2	-	-	-	-	-	-	-	2	1.18	1:100
arborea	1	-	-	-	-	-	-	-	1	0.59	1:100
TOTAL	45	33	26	25	21	13	5	1	169	100.00	-
%	26.6	19.5	15.4	14.8	12.4	7.7	3.0	0.6	100.0	-	-

Table 2

A survey of the incidence of antibodies to Leptospira interrogans (L.i.) in the sera of police dogs in July-August 1984

Serovar L.i.	1:100	1:200	1:400	1:800	1:1600	1:3200	1:6400	1:12800	total	%	$\bar{X}$ g
grippytophosa	47	14	9	21	11	7	3	-	112	51.85	1:328
sejroe	10	7	15	7	3	1	-	-	43	19.91	1:335
icterohaemorrhagiae	10	3	3	1	3	1	1	-	22	10.19	1:301
bratislava	3	2	6	2	1	-	-	-	14	6.48	1:328
bulgarica	3	-	-	-	-	-	-	-	3	1.38	1:100
sorex-jalna	2	-	2	1	-	-	-	-	5	2.31	1:263
pomona	9	1	1	-	-	-	1	-	12	5.55	1:168
canicola	3	1	-	-	-	-	-	-	4	1.85	1:119
arborea	1	-	-	-	-	-	-	-	1	0.46	1:100
TOTAL	88	28	36	32	18	9	5	-	216	100.00	-
%	40.7	13.0	16.7	14.8	8.3	4.2	2.3	-	100.0	-	-

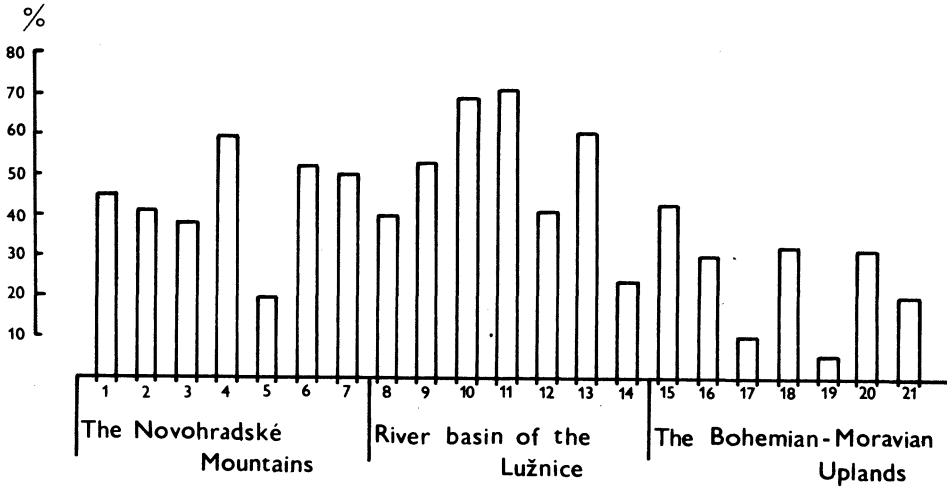


Fig. 1. Incidence of antibodies to *Leptospira interrogans* in police dogs at 21 posts in three areas under study in 1984 (n = 586)

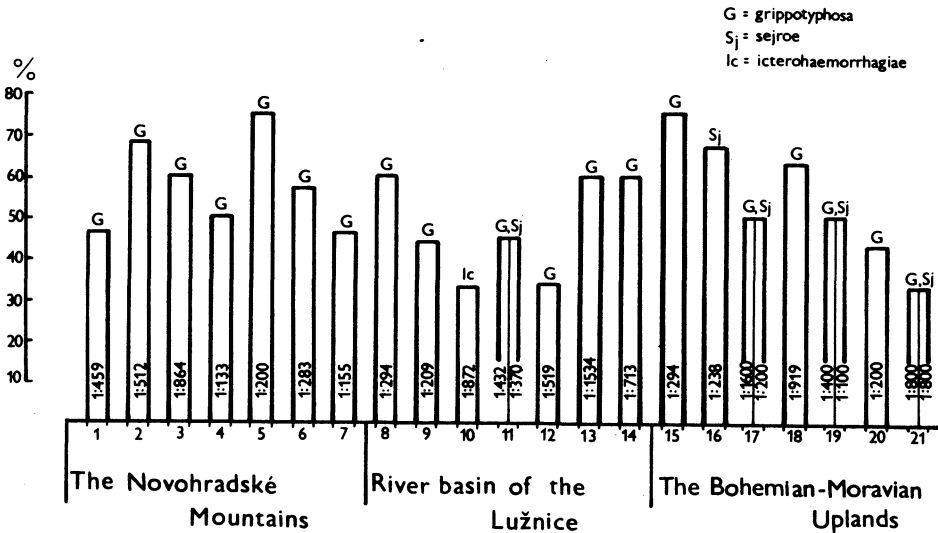


Fig. 2. The most frequently demonstrated serovars of *Leptospira interrogans* (expressed as percentages of all *L. interrogans* serovars demonstrated in the study) at 21 posts of police dogs in 1984 (n = 241)

posts an equal frequency of antibodies to serovar grippophytosa and to leptospirae of group Sejroe was found. The blood sera of dogs at the remaining two posts showed the highest frequency of antibodies to group Sejroe and to serovar icterohaemorrhagiae (copenhageni), respectively.

### Discussion

The dogs in our study were examined deliberately first in winter and then in summer to find whether the increased possibility of their contact with wildlife animals (reservoirs of leptospirae) would manifest itself in the incidence of leptospiral antibodies as regards the percentage of serologically positive dogs, titre height and the number of serovars. Our presumption proved to be true. The proportion of dogs with leptospiral antibodies rose from 56.71 % in winter to 69.01 % in summer. The most frequent findings on both occasions were antibodies to serovar grippophytosa: they were found in 77 cases (25.83 %) in winter and in 112 cases (35.78 %) in summer. The incidence of leptospiral antibodies to group Sejroe showed a moderate decrease from 14.76 % in winter to 13.73 % in summer. Antibodies to serovar icterohaemorrhagiae (copenhageni) showed an upward trend in summer: from 5.7 % to 7.02 %. A mild rise was also observed in the incidence of antibodies to serovar bratislava: from 2.68 % in winter to 4.47 % in summer. The increase in leptospiral antibodies to the serovars in summer was demonstrated mostly in low titres. Both examinations revealed leptospiral antibodies to the same 9 serovars. Antibodies to serovars tarassovi, jalna and bataviae were not demonstrated. Antibodies to serovars bulgarica, canicola, arborae and pomona were found only in low titres of 100 and 200 and only concurrently with other reactions. Therefore it seems reasonable to regard these findings as coagglutination with other leptospiral serovars, mainly serovar grippophytosa and serovar icterohaemorrhagiae (copenhageni) that were demonstrated concurrently in higher titres.

Considering that our results obtained in winter were different from those obtained in the same dogs in summer, leptospiral findings in dogs based merely on a single examination or reported by some investigators without specification of the season do not provide, in our view, a true picture of the incidence of leptospiral antibodies and are not comparable with our results. The situation as reported in our study is in keeping with the observations of Šebek (1961), Šebek and Janíček (1964) and Šebek and Wurst (1972) who arrived at roughly the same results in their studies conducted in our country. As to the results reported abroad, our findings agree in part with the observations made by Zaharij and Modrič (1968) in Yugoslavia and by Hill et al. (1976) in Holland with respect to both the per cent incidence of leptospiral antibodies and the frequency of serovars involved.

The finding that the most frequently demonstrated leptospiral antibodies in our study were those to serovar grippophytosa and to group Sejroe is in keeping with the observations of Pokorný et al. (1964) who in their study on the incidence of leptospiral antibodies in a large number of wild small terrestrial

mammals in South Bohemia also found the most frequent involvement of serovar grippophytosa and of group Sejroe.

Comparison of our findings obtained in the three areas under study showed characteristic differences between them in the extensity of the incidence of leptospiral antibodies as well as in the relative proportions of serovars involved. At posts situated in the area of the Novohradské Mountains leptospiral antibodies were demonstrated in 43 % of the dogs. In the wet upper river-basin of the Lužnice leptospiral antibodies were demonstrated in more than 50 % of the dogs. In the area of the Bohemian-Moravian Uplands leptospiral antibodies were found in only 24 % of the dogs. In the area of the Novohradské Mountains antibodies to serovar grippophytosa predominated at all posts. In the upper river-basin of the Lužnice antibodies to serovar grippophytosa also showed an overall predominance, although at one post antibodies to serovar icterohaemorrhagiae (copenhageni) prevailed. In the area of the Bohemian-Moravian Uplands leptospiral antibodies to group Sejroe were found in addition to those to serovar grippophytosa.

Comparison of the results obtained by us in dogs with those reported for wildlife animals as reservoirs and hosts of leptospirae and with published observations on natural foci of leptospirosis showed that the dogs had leptospiral antibodies only to serovars that were reported to have given rise to natural or synanthropic foci of leptospirosis in the areas under study. The findings in dogs in individual areas may be influenced by the fact to what extent and with which species of synanthropic rodents the respective kennels are infested. This may explain the incidence of antibodies to leptospirae of group Sejroe and to serovar icterohaemorrhagiae (copenhageni) at some posts. Here comes into play the characteristics of each area as regards its rodent reservoirs of leptospirae (house mice on the premises or brown rats in wild scrap-heaps) of the respective serovars.

The fact that the proportion of dogs showing leptospiral antibodies was higher in summer indicates that the infection of dogs occurs mainly upon contact with animals from natural reservoirs of leptospirae or upon exposure to an environment contaminated by such animals. In summer these wild rodents are present in the environment in particularly large numbers and therefore the likelihood of contact between them and dogs is higher than in winter. From this it seems reasonable to infer that in these types of leptospirosis the spread of infection from dog to dog is of no great importance and that the role of the dog in the epidemiology of these leptospiroses can be regarded as minimal. Nevertheless, a definite answer to these questions must await further investigations.

#### Výskyt protilátek proti jednotlivým sérovarům *Leptospira interrogans* u služebních psů

V roce 1984 jsme vyšetřili sérologicky k průkazu protilátek proti leptospirám skupinu služebních psů plemene německý ovčák Pohraniční stráž v Jihočeském kraji. V zimě jsme vyšetřili 298

psů, v létě 313 psů. Protilátky proti leptospirám různých sérovarů jsme prokázali v zimě v 56,71 %, v létě v 69,01 %. Prokázali jsme protilátky proti leptospirám 9 sérovarů. Nejčastěji pak proti leptospirám sérovaru grippotyphosa, icterohaemorrhagiae resp. copenhageni a leptospirám skupiny Sejroe.

Vzestup procentuálního zastoupení psů s protilátkami v létě, především s leptospirami sérovaru grippotyphosa a icterohaemorrhagiae resp. copenhageni si vysvětlujeme častějším kontaktem psů s rezervoárovými zvířaty těchto leptospir, tj. hrabošem polním (*Microtus arvalis*) a potkanem (*Rattus norvegicus*), jejichž početní stavy v létě popřípadě na podzim ve volné přírodě kulminují.

Zjistili jsme rozdíly ve výskytu protilátek proti leptospirám u služebních psů podle biocenózy, v níž se stanoviště psů nachází. Pro výskyt protilátek proti leptospirám u psů je rozhodující, jakým způsobem a ve kterém ročním období se psi v daném prostředí pohybují.

#### Наличие антител отдельных типов сывороток *Leptospira interrogans* у служебных собак

В 1984 г. проводили серологические исследования определения антител против лептоспир группы служебных собак породы немецкая овчарка Погранвойск Южно-Чешской области. Зимой исследовали 298 собак, летом - 313 собак. Антитела против лептоспир разных сывороток установили зимой в 56,71% и летом в 69,01% случаев. Определяли антитела против лептоспир 9 типов сывороток, чаще однако против лептоспир *grippotyphosa icterohaemorrhagiae* или *copenhageni* и лептоспир группы *Sejroe*.

Увеличение процентного наличия собак с антителами летом, прежде всего с лептоспирами *grippotyphosa* и *icterohaemorrhagiae* или *copenhageni* объясняем прежде всего более частым контактом собак с промежуточными хозяевами упомянутых лептоспир, т.е. полевой обыкновенной (*Microtus arvalis*) и пасюком (*Rattus norvegicus*), численность которых летом или осенью достигает в свободной природе своей вершины.

Была установлена разница наличия антител против лептоспир у служебных собак по биотопу места нахождения псарни. Для наличия антител против лептоспир у собак решающим являются способ и время года передвижения собак в данной среде.



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