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Rodents as possible reservoirs of leptospirosis in extensive swine breeding systems

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ABSTRACT

In the territory of the Forestry of Velika Gorica in the economic unit "Turopoljski Lug" investigations were carried out on the distribution of leptospira in rodents and swine of autochthonous breed of Turopolje living on that area and traditionally being extensively bred. In total the samples of 31 rodents of the following species were analysed: Apodemus (A.) agrarius, A. sylvaticus, A. flavicollis Clethrionomys glareolus, Microtus (M.) agrestis and M. arvalis. In addition, 52 blood sera of Turopolje swine were analysed. The distribution of leptospirosis in rodents and swine was demonstrated by isolation of rhinoculture (rodents) and findings of antibodies to leptospira by the reaction of microscopic agglutination. The antibodies to leptospirosis were established in six (19.4%) out of 31 blood samples of rodents analysed and of all the samples bacteriologically analysed leptospira were isolated from 1 sample 3.2%. The largest number of positive serological reactions was established in the species A. flavicollis and the antibodies to leptospira serovar (sv.) sv. australis (in three cases) and sv. pomona (in one case) were demonstrated. In the species C. graleoulos sv. sejroe and sv. australis (in one case each) were established. In swine the antibodies were established in eleven (21.1%) blood samples out of 52 blood samples of Turopolje swine analysed. The antibodies to sv. icterohaemorhagiae (two swine), sv. australis (seven swine), sv. pomona and sv. grippotyphosa (two swine) were demonstrated. Our investigation revealed the distribution of identical sv. of leptospira in rodents and swine living in the same territory (sv. australis and sv. pomona). The mice-like rodents are natural reservoirs of leptospira, thus representing a significant potential source of infection for swine kept in extensive breeding systems.
(Keywords: rodents, swine, leptospirosis)

INTRODUCTION

Leptospirosis is an acute septicaemical contagious disease of different kinds of domestic and wild animals and humans (zoonoses). The causes are different types of leptospira. Leptospirosis is a mild, benign, not so often severe septicaemia in piglets and young swine and in pregnant sows it causes abortions or stillborn or piglets alive but incapable to live. The sources of the infection are sick animals shedding leptospira in the urine. Small rodents are natural reservoirs of leptospira and may be the carriers for life. The urine of rodents and domestic animals contaminates the environment, grass, surface waters, muddy and swampy

areas where leptospira persist, so such contaminated environments are the sources of infection for animals and humans.

Cho et al. (1998) described the findings of leptospira in 9.9% of rodents of *A. agrarius* kind and isolated *sv. icterohaemorrhagiae. Songer et al*. (1983) analysed 358 rodents from six localities in Arizona, isolated leptospira in 10.4% of them with *sv. ballum* as a dominating species. *Morales et al.* (1978) described the isolation of leptospira *sv. pomona* from the kidneys of rats (*Rattus norvegicus*) which were the source of *sv. pomona* on a swine farm. In 48.6% of rat kidneys the authors found changes which could be associated with leptospirosis. As a source of leptospira *sv. pomona* on a swine farm *Whyte* and *Ratcliff* (1982) specified a field mouse (*Mus musculus*). Besides for swine, the rodents can be a source of leptospira also for other animals. *Kuiken et al*. (1991) identified voles (*M. arvalis*) as possible sources of leptospira *sv. hardjo* and *sv. grippotyphosa* in cattle. *Michel et al.* (2001) identified nutria (*Myocastor coypus*) as a possible source of leptospira for animals and humans. The authors reported that in six regions of France 738 nutrias were analysed serologically and bacteriologically. In particular regions positive reactions were established in 16.5% to 66% of nutrias. From those leptospira *sv. icterohaemorrhagiae*, *sv. sejroe* were isolated. *Borčić et al.* (1986) identified a striped field mouse (*A. agrarius*) as our natural reservoir of leptospira *sv. pomona*. The findings of positive reactions to leptospirosis were described in many kinds of wild animals (*Modrić* and *Karlović*, 1977; *Borčić et al*. 1989; *Kovačić et al.* 2001; 2002).

In this paper the investigations on the prevalance of leptospirosis in small rodents and autochthonous Turopolje swine are presented. Different kinds of mice-like rodents and their distribution in a particular region are described. They are also indicated as possible potential sources of infection for swine kept in extensive breedings.

MATERIALS AND METHODS

In the investigations for sampling small rodents the traps of "Sherman" type were used for catching the rodents either dead or alive (*Baumler* and *Brunner*, 1988; *Margaletić*, 1998). The traps were set in hunting areas. Apples and the mixture of oat flakes and sardines in oil were used as baits. The determination of sampled units was carried out according to *Niethammer* and *Krapp* (1978; 1982). In total the samples of 31 rodents were analysed serologically (blood samples) and bacteriologically (kidneys).

In swine blood for serological analyses was taken by puncturing the veins *cave cranialis*, *jugularis* or an ear vein. On that occasion the blood samples of 52 Turopolje swine were serologically analysed. The swine were kept in an extensive system in the woodlot of English oaks and swampy meadows according to an old Croatian technology of low feed input and utilizing the natural resources and taking care of the balance in the environment.

The distribution of leptospirosis in small rodents and Turopolje swine was demonstrated by the findings of antibodies in their sera. As an evidence of antibodies in the sera of rodents and swine the method of microscopic agglutination was used as a standard way of serological diagnostics and classification of leptospira. In the case of demonstrating antibodies the blood samples are analysed in further dilutions of the sera (1:100, 1:200 etc.) The findings of the highest titre of antibodies for a particular antigen of leptospira and respectively the serovar in the sera indicates the "probable" serovar which caused the infection (*Johnson,* 1976). All the blood samples were analysed with the antigens of *L. interrogans* sv.: *icterohaemorrhagiae, ballum, australis, pomona, grippotyphosa, sejroe, saxkoebing, tarassovi, canicola, bataviae* and *hardjo*. The kidneys of the rodents were set on Kothof's media with the purpose of isolating leptospira.

RESULTS AND DISCUSSION

In the sampled material the following species of small rodents were identified: *A. agrarius, A. flavicollis, A. sylvaticus, Clethrionomys glareolus, M. agrestis* and *M. arvalis.* In the sampled material *A. flavicollis* was a dominating caught species. In total 31 rodents were entrapped. In the sample of 31 caught rodents the antibodies were established in six (19.3%) animals. The most serologically positive reactions were established in the species *A. flavicollis* in four rodents out of 10 caught and in the species *C. glareolus* positive reactions were established in two rodents out of five caught ones. In other species serologically positive reactions to leptospirosis were not established. In the species *A. flavicollis sv. australis* (in three cases) and *sv. pomona* (in one case) was established, while in the species *C. glareolus sv. sejroe* and *sv. australis* was established (*Table 1*).

In swine the antibodies to leptospira were established in eleven (21.1%) blood samples out of 52 blood samples of Turopolje swine. The antibodies to *sv. icterohaemorrhagiae* (in two swine), *sv. australis* (in seven swine), *sv. pomona* (in one swine) and *sv. grippotyphosa* (in one swine) were demonstrated (*Table 2*).

Table 1

Presentation of the caught rodents by species and the findings of antibodies to leptospira

Kind of Rodent	Caught Animals	Findings of Antibodies to Leptospira
Apodemus agrarius	2	0
Apodemus flavicollis	10	4
Apodemus sylvaticus	9	0
Clethionomys glareolus	5	2
Microtus agrestis	2	0
Microtus arvalis	3	0
Total	31	6

Table 2

Presentation of the number and percentage of positive animals investigated with particular types of leptospira

L. interrogans	**Positive swine blood samples**		**Positive rodents**		**Total number of animals positive to leptospirosis**	
	Number	**%**	**Number**	**%**	**Number**	**%**
sv. icterohaemorr.	2	18.2	0	0	2	11.8
sv. australis	7	63.6	4	66.6	11	64.6
sv. pomona	1	9.1	1	16.7	2	11.8
sv. sejroe	0	0	1	16.7	1	5.9
sv. grippotyphosa	1	9.1	0	0	1	5.9
Total	11	100	6	100	17	100

The epizooties of leptospirosis can be understood only if being considered as a wider biological phenomenon, as is the case with many other anthropozoonoses. An age-long persistence of leptospira genus is made possible by animals. On the list of leptospira reservoirs there is a large number of animals, mostly vertebrates - mammals, birds and amphibians. The survival of leptospira in nature is made possible by a so-called "basic host" which in certain natural biocenosis and symbiosis makes their survival possible.

This is known for *sv. icterohaemorrhagiae* where the basic host is a migrant rat (*Rattus norvegicus*), *sv. grippotyphosa* and a field vole (*M. arvalis*), *sv. pomona* and a striped field mouse (*A. agrarius*) and a swine, *sv. sejroe* and a house mouse (*Mus musculus*), *sv. saxkoebing* and ayellow-necked mouse (*A. flavicollis*) (*Borčić*, 1982). The species mentioned can be the carriers of certain leptospira sv. for their whole life, which was particularly well investigated in rats and *sv. icterohaemorrhagiae* (*Zaharija*, 1954). The natural foci of leptospiroses spread along our large rivers Sava and Drava and they are supported by a field vole (*M. arvalis*) which is a natural reservoir of *sv. grippotyphosa* (*Borčić et al.*, 1987). Another example of such a natural focus is a striped field mouse (*A. agrarius*), specifically for *sv. pomona* (*Borčić et al.*, 1986). In these regions in mice-like rodents the presence of some other leptospira is also demonstrated: *sv. saxkoebing, sv. australis, sv. bataviae*, hence, it is presumed that here they also find favourable conditions for survival (*Borčić et al*., 1978). In our investigations *A. flavicollis* was a species in which the antibodies to leptospira were demonstrated most often, being followed by the species *Clethrionomy glareolus*. *Borčić et al*., (1978) identified a striped field mouse (*A. agrarius*) and a timber vole (*C. glareolus*) as the most prevailing animal species infected with leptospira.

Our findings of 19.3% of serologically positive rodents is rather high. *Cho et al*. (1998) described the findings of leptospirosis in 9.9% of rodents of *A. agrarius* kind. *Songer et al.* (1983) found the antibodies to leptospira in 10.4% of rodents at six localities in Arizona.

Borčić et al. (1989) carried out the investigations concerning the presence of leptospirosis in roe deer, fallow deer, hares and wild boars. The authors reported that the antibodies were most often found in boars, specifically in 13 (11.6%) out of 112 blood samples of the boars analysed. The findings of 21.1% of seropositive reactions to leptospirosis in Turopolje swine is quite considerable and indicates the possibility of contacts of the swine mentioned and the rodents in Turopoljski Lug. Surely, this is favoured by the surroundings, wet and swampy soil suitable for the development of leptospira and exactly in such areas these investigations were carried out. Such conclusion is indicated by almost the same percentage of swine (21.1%) and rodents (19.3%) serologically positive to leptospirosis as well as the findings of antibodies to *sv. australis* in 63.6% of positive swine and 66.6% of rodents and also the findings of antibodies to *sv. pomona* in 9.1% of swine and in 16.7% of rodents.

Leptospirosis in swine is mostly a mild disease and rarely a severe septicaemia. Most often it is manifested by abortions in heavily pregnant sows or by delivering dead piglets or those incapable to live. The most frequent serovares causing abortions in swine are *sv. pomona* and *sv. tarassovi* (*Zaharija* and *Perić*, 1966). Swine can be the carriers of leptospira germs for a year after the incidence of the infection (*Zaharija et al.*, 1976). *Morales et al.* (1978) described the isolation of leptospira *sv. pomona* from the kidneys of rats which were the source of *sv. pomona* on a swine farm. *Whyte* and *Ratcliff* (1982) as a source of leptospirosis *sv. pomona* on a swine breeding farm identified a field mouse (*A. agrarius*).

Kuiken et al. (1991) reported that voles (*M. arvalis*) were the possible sources of leptospira *sv. hardjo* and *sv. grippotyphosa* also in cattle.
Leptospirosis is zoonosis, thus *Fališevac* (1951) reported on the focus of leptospirosis in a swine breeding in which five women got ill with leptospirosis in the period of one month.

CONCLUSIONS

In the region investigated leptospirosis spreads in rodents and Turopolje swine. In the same area the prevalence of identical serovar of leptospira has been noted in rodents and swine *(sv. australis* and *sv. pomona*).

The mice-like rodents are the natural reservoirs of leptospira and represent a significant potential source of the infection for swine kept in extensive breedings and thereby represent also a danger for humans.

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